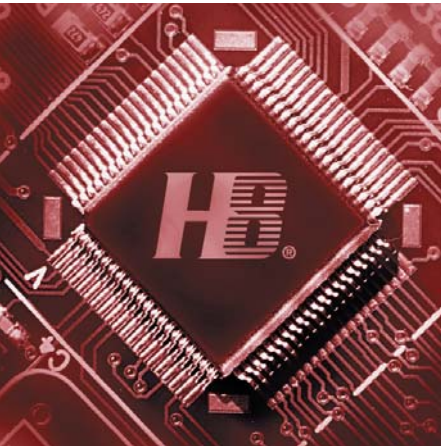




# H8<sup>®</sup> Family of Microcontrollers



# Renesas Technology America

## H8® Family of Microcontrollers

## 2006 Catalog



**RENESAS IS  
#1  
WORLDWIDE  
IN MCU  
SHIPMENTS**

In 2005, Renesas earned a **23%** share of the global MCU market — more than any other supplier — and an **11%** market share in the Americas (a 12% increase), according to Gartner Semiconductor Industry Worldwide Annual Market Share Database, March 31, 2006



**RENESAS  
ACHIEVED  
12%  
MARKET SHARE  
GROWTH IN THE  
AMERICAS IN 2005!**

## Renesas — Your Best Decision for Microcontrollers and Microprocessors

*Choose for your next design; use for all your future ones.*

Renesas Technology, the #1 global supplier of microcontrollers, offers hundreds of devices in our H8®, R8C/Tiny, M16C™ and SuperH® families, among others, that have solid technology roadmaps and cover wide spans of performance, integration, power efficiency and price points. Our advanced silicon solutions simplify system optimizations, facilitate design enhancements and diversifications, and help you meet tight cost budgets. You can shorten your system design cycles and improve your time-to-market by taking advantage of our total system support, which includes starter kits, HW/SW tools, reference designs/platforms, example software code, and middleware. Expert third-party support is available as well.



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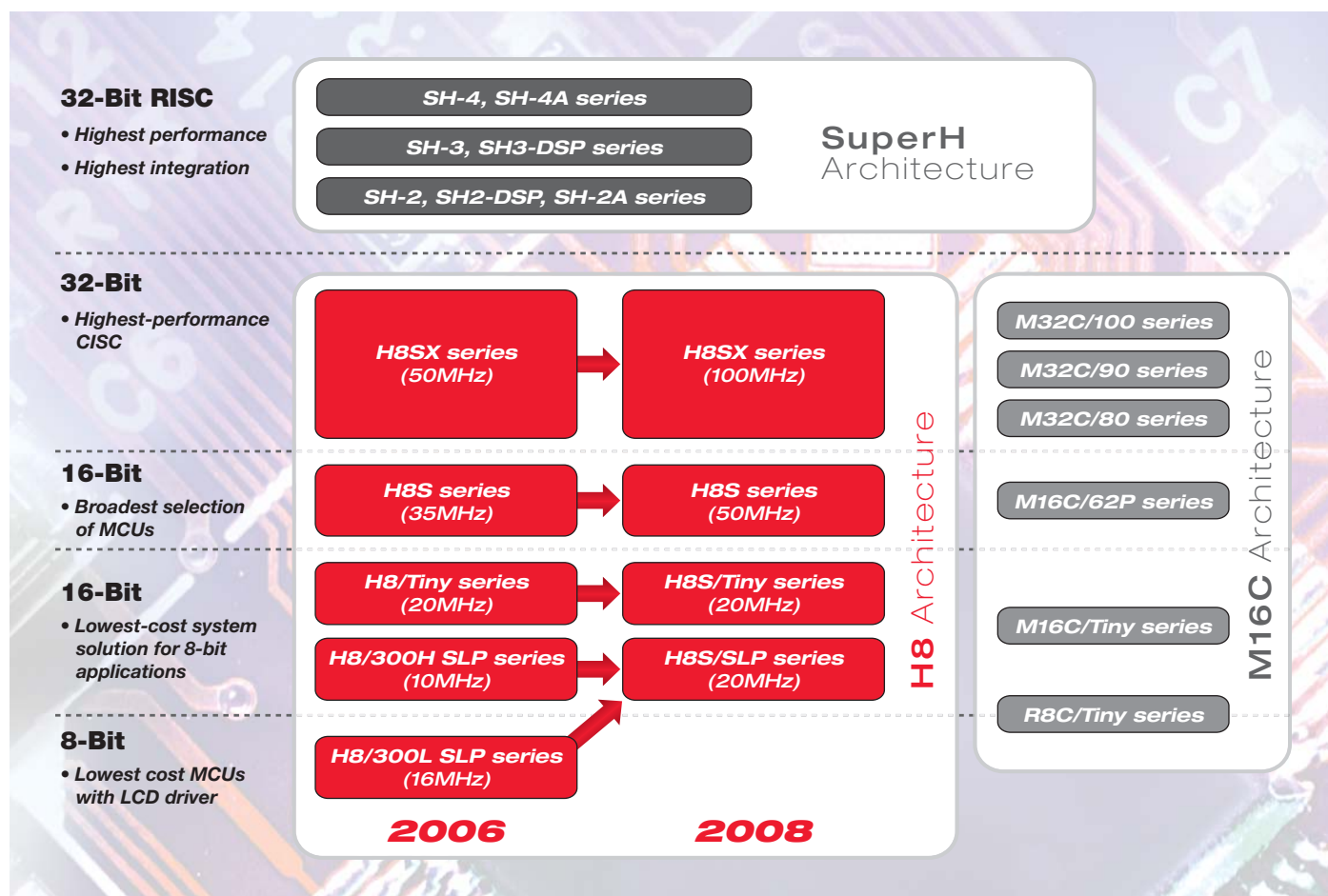
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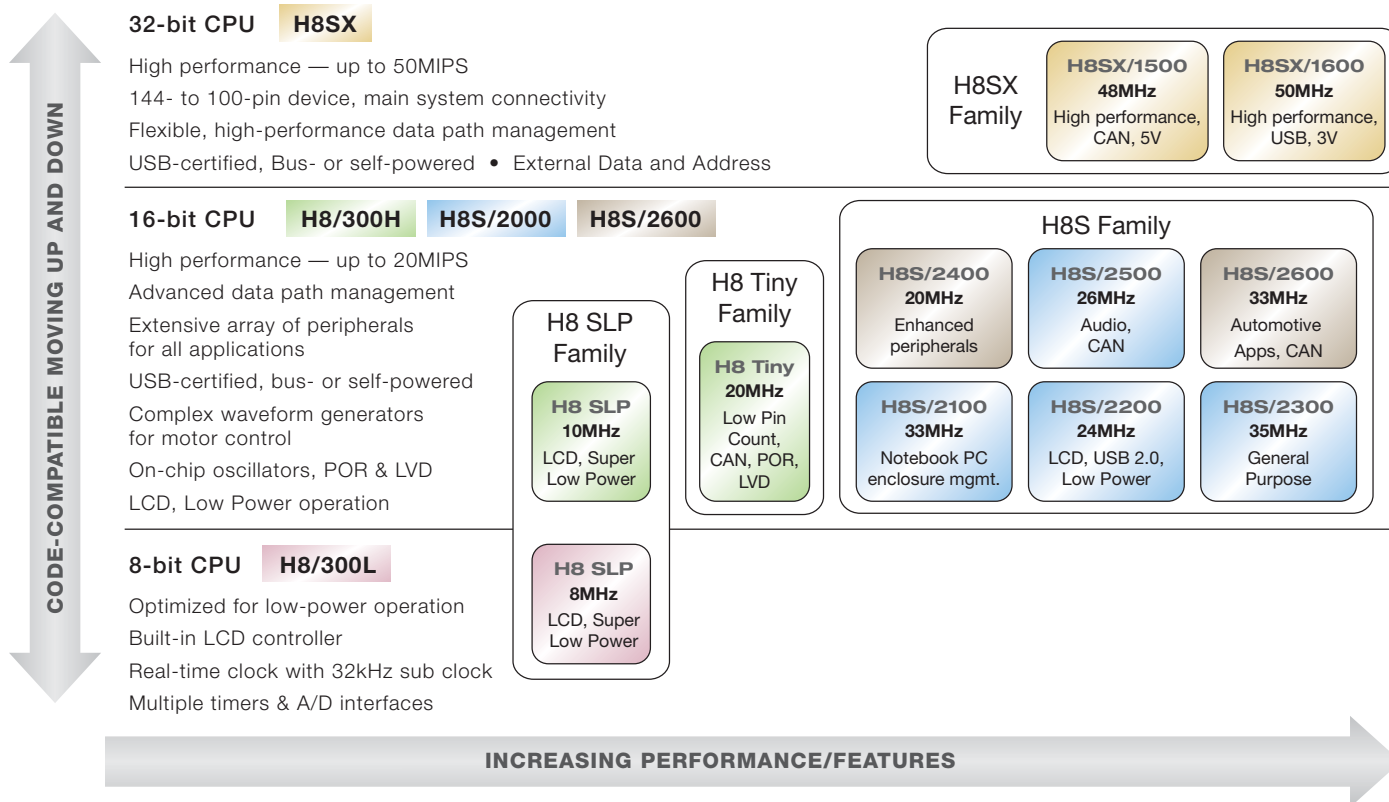
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| Market Needs                                                               | Renesas H8 Solutions                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High performance                                                           | Speeds up to 50MHz, providing 50MIPS with single-cycle flash access                                                                                                                                                                                                                                                                                                               |
| Wide range of programmable memory                                          | Single-voltage-programmable on-chip flash — 8KB to 1MB                                                                                                                                                                                                                                                                                                                            |
| Wide range of low-cost memory                                              | Mask-ROM versions for many flash MCUs — 2KB to 512KB                                                                                                                                                                                                                                                                                                                              |
| Integrated peripherals, including support for industry-standard interfaces | Devices in the H8 series offer more than 100 different on-chip peripherals <ul style="list-style-type: none"> <li>• Match peripheral set to application</li> <li>• Choose from timers, A/Ds, D/As, on-chip oscillators, low-voltage detect, and DMA functions, among many others</li> <li>• UART, SPI, I<sup>2</sup>C, IrDA, CAN, LIN, USB, Smart Card, LCD, POR, etc.</li> </ul> |
| Low power consumption                                                      | <ul style="list-style-type: none"> <li>• Super-low-power CMOS technology — 200μA @ 1MHz, 0.4μA @ 32kHz</li> <li>• Up to eight power-down modes</li> <li>• 32kHz sub-clock oscillator</li> </ul>                                                                                                                                                                                   |
| Low radiation noise                                                        | Improved technology and design techniques for a 20dB reduction in noise compared to conventional products                                                                                                                                                                                                                                                                         |
| Development environment                                                    | <ul style="list-style-type: none"> <li>• Fully integrated tool suite of H/W and S/W tools</li> <li>• Highly optimized Renesas C/C++ compiler</li> <li>• 100% upward code compatibility</li> </ul>                                                                                                                                                                                 |
| Cost/performance                                                           | Best in the industry                                                                                                                                                                                                                                                                                                                                                              |
| Support and training                                                       | <ul style="list-style-type: none"> <li>• Experienced application engineers</li> <li>• Training courses and development tools available online at <a href="http://www.renesasinteractive.com">www.renesasinteractive.com</a></li> </ul>                                                                                                                                            |

## The H8 Family Roadmap



Renesas Technology America, Inc. is a leading supplier of 8/16/32-bit microcontrollers (MCUs) and microprocessors. The cost-competitive Renesas MCUs in the H8® family are ideal for low-power, high-performance embedded systems in consumer, industrial, medical, communication and automotive applications.

### MCU Series in the H8 Family

The H8 microcontroller family encompasses a wide range of devices, from 8-bit low-cost, super-low-power, low-pin-count MCUs to 32-bit high-performance devices. Upward code compatibility is maintained in the various H8 MCU series.

The **H8/300L** and **H8/300H** super-low-power (SLP) MCUs are excellent solutions where battery life is critical.

The **H8 Tiny** series devices provide the performance of 16-bit MCUs, yet are economical enough for many 8-bit applications.

The **H8S/2100** series includes a device with multiple serial interfaces that are optimized for enclosure management control in PC/Server (IPMI) and notebook applications. This family includes certified high-speed USB functionality.

The **H8S/2200** series MCUs include devices with a USB v2.0-compatible interface (Bus or Self powered) and devices with a 40-segment LCD controller that's a great match for low-cost PC peripherals, metering instruments, and medical diagnostic equipment.

The **H8S/2300** series MCUs provide many device choices for optimizing system cost, performance and features.

The **H8S/2400** series MCUs have enhanced peripherals for use with LCD monitors and other home electronics.

The **H8S/2500** series MCUs are designed for audio and automotive applications. This series features multiple serial ports, I<sup>2</sup>C and CAN, and includes selectable 3V and 5V signaling on the GPIO lines.

The **H8S/2600** series MCUs have on-chip HCAN (Hardware Controller Area Network) controllers and are top choices for automobile and industrial applications.

The **H8SX** series MCUs provide a 32-bit performance upgrade path for the H8 family, maintaining code compatibility and offering a rich set of on-chip peripherals.

### H8 Series MCU Product Overview

| H8 Series   | CPU    | MHz | Address Space | Features / Remarks                                                                                                | Applications                                                                                                   |
|-------------|--------|-----|---------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| H8/300L SLP | 8-bit  | 8   | 64KB          | Super low power, LCD driver, Low-Voltage Detect, Power-On Reset                                                   | Utility meters, glucose meters, battery-powered security devices, home electronics, HVAC controls              |
| H8/300H SLP | 16-bit | 10  | 16MB          | Super low power, LCD driver with voltage boost, 14-bit ADC, 1.8V Flash, 0.5μA @ 32kHz                             | Thermostats, HVAC, glucose meters, security sensors, building automation, lawn sprinkler control               |
| H8/Tiny     | 16-bit | 20  | 16MB          | Low pin count, smaller package, POR, LVD, CAN, LIN, SPI                                                           | White goods, home electronics, automotive control systems, controller for small motors                         |
| H8S/2100    | 16-bit | 33  | 16MB          | LPC bus interface, multiple I <sup>2</sup> C busses, PS/2 interface, multiple PWM, 16-channel ADC, high-speed USB | Notebook PC power management, enclosure management for servers/routers, IPMI applications, USB digital cameras |
| H8S/2200    | 16-bit | 24  | 16MB          | Low power, LCD controller, USB v2.0, I <sup>2</sup> C, smart card interface                                       | PC peripherals, barcode scanners, medical equipment, HVAC, utility meters, electronic point-of-sales equipment |
| H8S/2300    | 16-bit | 35  | 16MB          | Smart card interface, DMA controller, SDRAM interface                                                             | General applications, label printers, GPS systems                                                              |
| H8S/2400    | 16-bit | 20  | 16MB          | Low power, hardware multiplier, I <sup>2</sup> C, enhanced timers, multiple serial channels                       | LCD monitors, LCD-TVs, plasma-TVs, projectors, home electronics                                                |
| H8S/2500    | 16-bit | 26  | 16MB          | Low power, 3V and 5V I/Os, enhanced communication channels                                                        | Audio, automotive audio                                                                                        |
| H8S/2600    | 16-bit | 33  | 16MB          | HCAN, H/W MAC, smart card interface, PC break controller, DMA controller, SDRAM interface                         | Airbag controllers, tire pressure monitors, power steering controllers, pump controllers, siren controllers    |
| H8SX/1500   | 16-bit | 48  | 16MB          | Fast multiply and divide, enhanced bit manipulation, CAN                                                          | Automotive body control                                                                                        |
| H8SX/1600   | 32-bit | 50  | 4GB           | Fast multiply and divide, enhanced bit manipulation, USB, SDRAM interface                                         | ePOS, barcode scanners, printers, fitness equipment, USB devices                                               |

### A Global Leading Position

Renesas Technology has acquired an impressive reputation for leadership and earned a large share of the embedded processor market growth areas of industrial and commercial applications. For example, H8S/2100 devices have gained about a 70% worldwide share of microcontrollers used in PC Server power management.



## H8 MCUs: Fully Upward Compatible

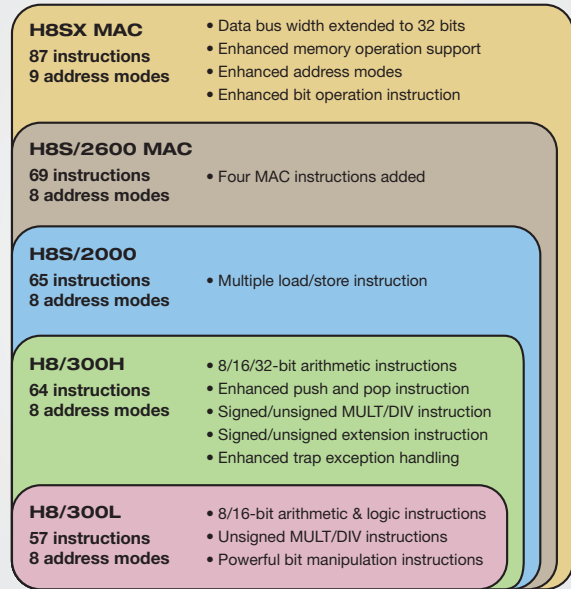
H8 CPUs are all CISC-based (Complex Instruction Set Computation), developed to allow compatibility up and down the various H8 series. This makes it easy to move between the product lines in the H8 family.

The CPUs within the H8 family range from 8-bit, low-power optimized cores, to full 32-bit high-performance cores that achieve 1MIPS/MHz.

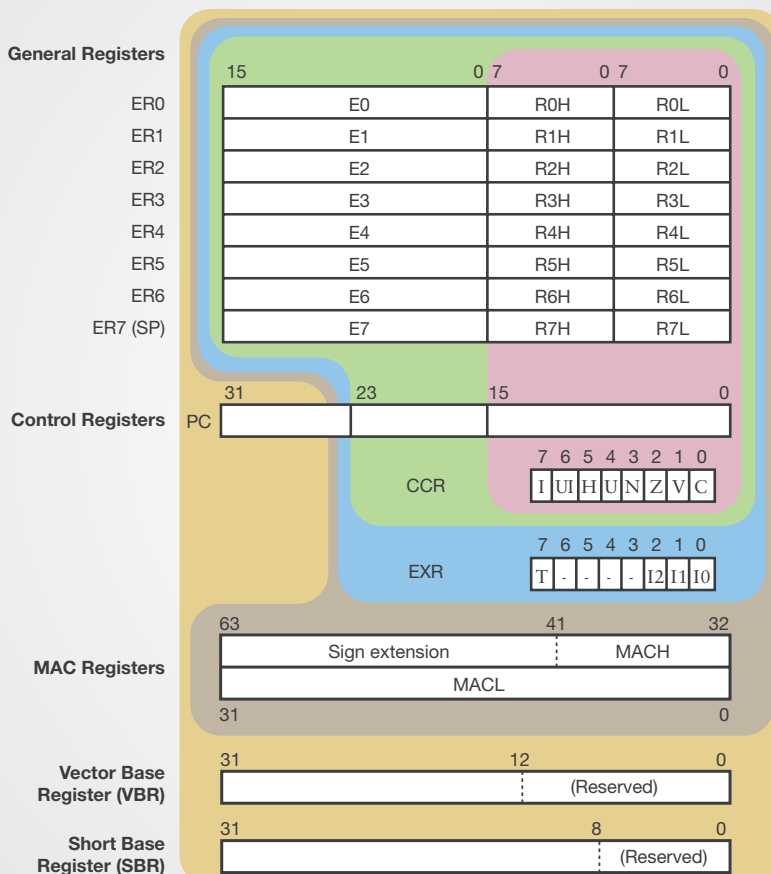
### Benefits of H8 CPU cores include:

- Most instructions execute in one clock cycle
- Built-in hardware MAC (H8S/2600 and H8SX only)
- Fast multipliers and dividers
- Enhanced memory addressing schemes (memory-to-memory access, one instruction)
- Advanced conditional branching instructions
- Powerful CISC instructions with small code size

## Upward Compatibility



## H8 CPU Register Set Diagram



## CPU Register Set

The CPUs within the H8 family are designed from the same register set, allowing complete compatibility.

### H8/300L devices

use 8 general-purpose registers as 8 and 16 bits. PC is 16 bits wide.

### H8/300H devices

use 8 general-purpose registers as 8, 16 and 32 bits. PC is 24 bits wide.

### H8S/2000 devices

use 8 general-purpose registers as 8, 16 and 32 bits. PC is 24 bits wide.

### H8S/2600 devices

use 8 general-purpose registers as 8, 16 and 32 bits. PC is 24 bits wide. Hardware MAC.

### H8SX devices

use 8 general-purpose registers as 8, 16 and 32 bits. PC is 32 bits wide. Hardware MAC. VBR and SBR available.

### H8 MCUs: Faster Execution Times

Besides maintaining compatibility within the family, H8 CPUs have been optimized for high performance.

The majority of the instructions in the powerful CISC instruction set will execute in one clock cycle, giving RISC-like operation.

### Enhanced Hardware for Performance

Enhanced multipliers and dividers are included in the CPU core to boost throughput for mathematical operations and further enhance the performance of the CPU cores.

The H8S/2600 and H8SX CPU cores each have a hardware MAC (Multiply and Accumulate) block for extra performance in applications that involve data computations.

### H8 Family CPU Core Overview

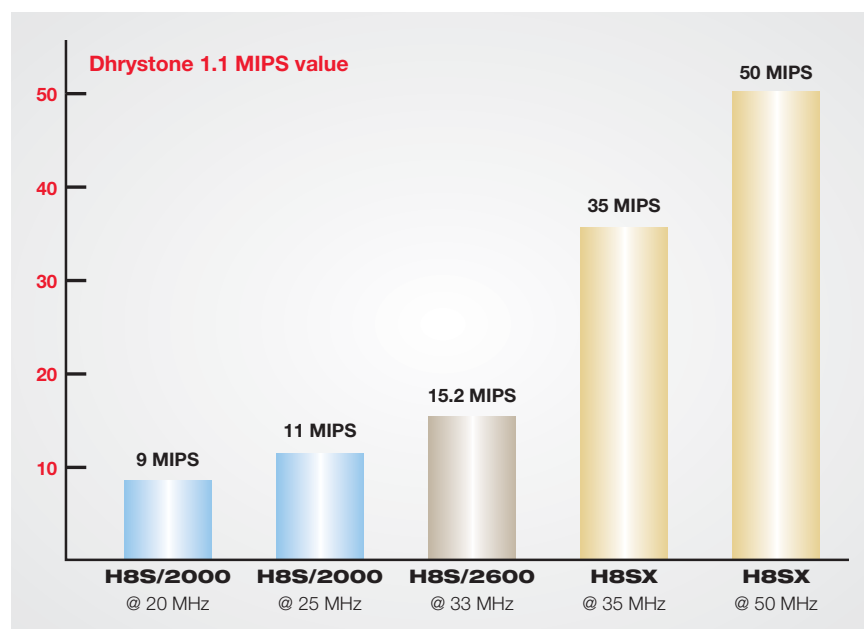
|                                     | H8/300   | H8/300H  | H8S/2000 | H8S/2600 | H8SX    |
|-------------------------------------|----------|----------|----------|----------|---------|
| <b>Basic Instructions Execution</b> | 2 cycles | 2 cycles | 1 cycle  | 1 cycle  | 1 cycle |
| <b>Bus Width</b>                    | 8-bit    | 16-bit   | 16-bit   | 16-bit   | 32-bit  |
| <b>No. of Instructions</b>          | 57       | 64       | 65       | 69       | 87      |
| <b>Address Space</b>                | 64KB     | 16MB     | 16MB     | 16MB     | 4GB     |

### Advanced Multiplier execution cycles

| Instruction | H8S | H8SX |
|-------------|-----|------|
| MULXU.B     | 3   | 1    |
| MULXU.W     | 4   | 1    |
| MULXS.B     | 4   | 2    |
| MULXS.W     | 5   | 2    |
| MULU.W      | -   | 2    |
| MULU.L      | -   | 5    |
| MULS.W      | -   | 2    |
| MULS.L      | -   | 5    |
| MULU/U.L    | -   | 6    |
| MULS/U.L    | -   | 6    |
| CLRMAC      | 1   | 1    |
| LDMAC       | 1   | 1    |
| STMAC       | 2   | 1    |
| MAC         | 4   | 4    |

### Advanced Divider execution cycles

| Instruction | H8S | H8SX |
|-------------|-----|------|
| DIVXU.B     | 12  | 10   |
| DIVU.W      | -   | 10   |
| DIVXU.W     | 20  | 18   |
| DIVU.L      | -   | 18   |
| DIVXS.B     | 13  | 12   |
| DIVS.W      | -   | 11   |
| DIVXS.W     | 21  | 20   |
| DIVS.L      | -   | 19   |



### H8 MCU System Performance

H8 microcontrollers are designed to deliver high throughput for excellent application performance.

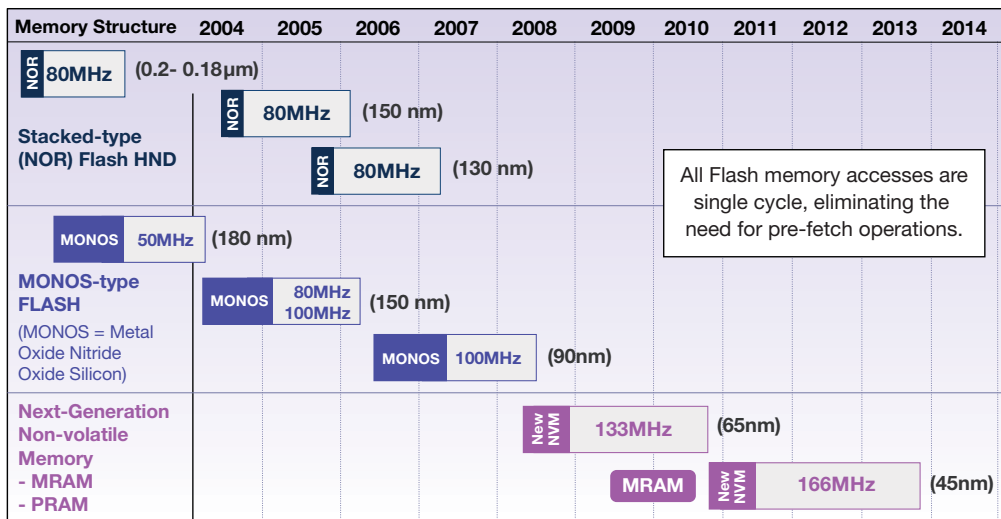
For example, their CISC CPU cores execute most instructions in just one clock cycle, and their Advanced Data Management peripherals utilize a 3-bus architecture to speed data transfers.

Also, the on-chip Flash can be accessed in a single cycle, achieving the best possible performance per MHz.

## TOP REASONS TO SELECT H8

### ■ Renesas: The #1 Flash MCU supplier

- Renesas, the world's #1 supplier of flash, has shipped over 1 Billion flash MCUs
- Wide range of sizes of highly reliable F-ZTAT (flash) up to 1MB, in 0.18µm process
- Fastest flash write time: 2.5 sec./ 128KB for 0.18µm process
- Access as fast as 10ns @ 100MHz
- Up to -40°C to +125°C range
- Multiple user-friendly modes for programming/reprogramming flash memory
- User mode allows flash to be programmed or erased by user application software



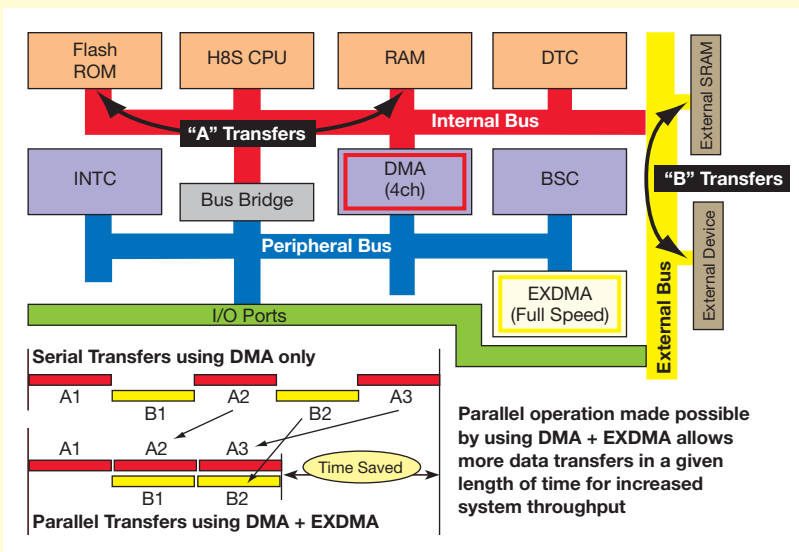
- Boot mode allows in-system programming using RS-232 serial port
- USB devices can be optionally programmed via the USB port
- User Boot mode allows storing a custom flash update routine in a special protected area
- Write mode enables MCU programming with desktop or production programmers
- Flash can be programmed via the on-chip debug emulator

### Powerful Data Path Management

H8 products are fully optimized system solutions, so besides powerful CPU core processing, H8 MCUs have advanced data path management.

There are three types of data movement engines: System DMA, External DMA and Data Transfer Controller. The Advanced Bus System Controller manages complex data and control across the multiple-bus architecture.

The H8S and H8SX MCU architectures use 3 separate buses. Data movement on the External Bus and System Bus can operate in parallel, greatly increasing system performance by optimizing operation per clock cycle.



This example shows system operation (red) using the System DMA, while in parallel the External DMA is transferring data between an external device and the MCU (yellow). This parallel operation reduces time for operation.

## TOP REASONS TO SELECT H8

### ■ On-chip Memory (SRAM)

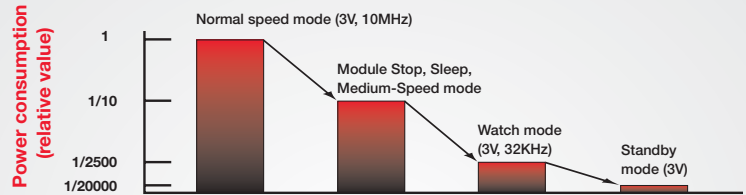
- Many sizes of on-chip high-speed SRAM: 256 Bytes to 56KB
- 8KB of JTAG debug memory can be used for system op. (allowing 64KB on-chip SRAM)
- Single-cycle access at maximum speed

### ■ Low Power Consumption

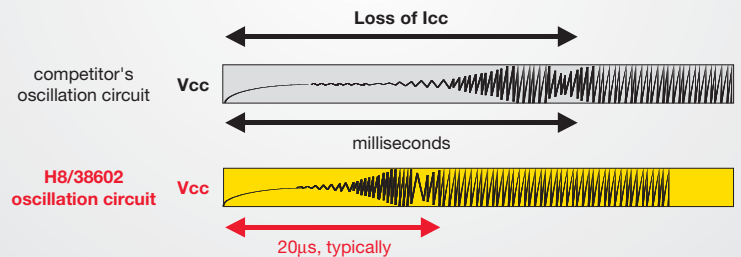
Multiple innovative techniques minimize MCU power consumption

- 0.4 $\mu$ A @ 32kHz
- Operating voltages as low as 1.8V
- Up to 8 power-down modes
- Module Standby mode allows software to selectively halt on-chip functions
- Dual clock oscillators with 32kHz sub-clock
- On-chip oscillators
- Short oscillator stabilization times (20 $\mu$ s, typically)
- Standby current as low as 0.1 $\mu$ A

### H8 Power Consumption: H8/38602

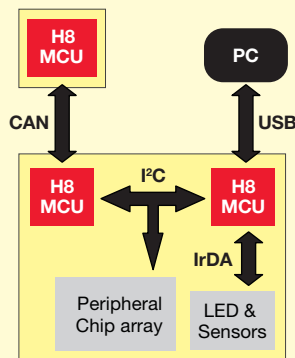


### Shorter Crystal Stabilization Time



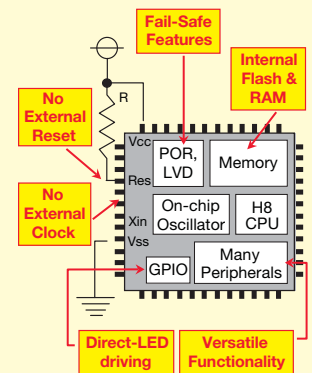
### Industry-standard Serial Communication Interfaces

- Certified USB full-speed and high-speed; bus- or self-powered
- Multiple channels of serial asynchronous/synchronous interface
- Synchronous serial unit (SSU) is compatible with Freescale (Motorola) SPI™
- I<sup>2</sup>C™ two-wire serial interface conforms to Phillips standard
- IrDA interface for easy wireless line-of-sight connectivity
- Smart Card interface conforms to ISO/IEC 7816-3
- Controller Area Network (CAN 2.0B) function for highly reliable networked embedded systems



### High component integration reduces system cost and design complexity

- On-chip oscillators as fast as 20 MHz available to CPU and all peripherals
- Low-voltage detect circuits to monitor power supplies efficiently without additional components
- Power-on Reset circuit eliminates external chip and guarantees a clean and reliable start-up
- High-current I/Os can drive LEDs directly
- LCD controllers with booster circuits drive higher voltage displays without the need of DC-DC converters
- Internal voltage regulators eliminate need for expensive power circuits
- Large range of internal reliable flash memory & high-speed RAM that suffice for most system requirements





### ■ DMA Controller (DMAC)

- Max. of 4 channels can be used
- Dual-address or single-address mode can be selected
- Supports Single, Burst, Sequential, Idle and Repeat Transfer modes
- Data can be transferred in word or byte units
- Activation: internal interrupt, external request, auto-request

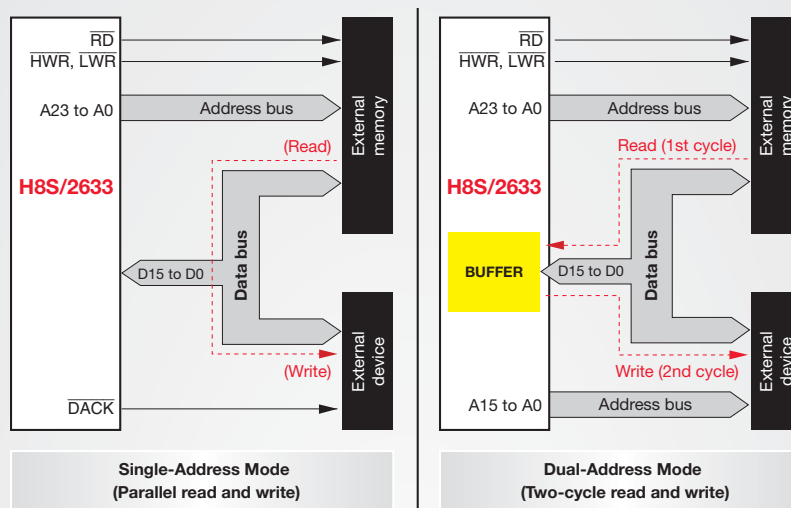
### ■ Data Transfer Controller (DTC)

- Max. of 85 channels can be used
- Multiple transfers or multiple types of transfers possible for one activation source
- Supports Single, Burst, Chain and Repeat Transfer modes
- Data can be transferred in byte or word units
- Activation sources: interrupt and software

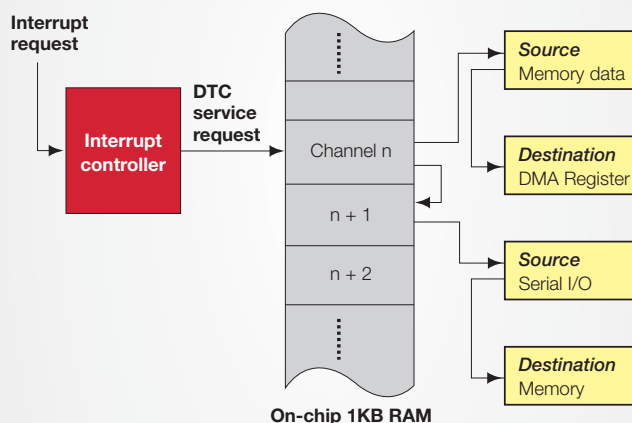
### ■ External DMA Controller (ExDMAC)

- Max. of 4 channels can be used
- Selection of byte or word transfer data length
- Transfer data in parallel with CPU or other internal bus master
- Dual-address or single-address mode can be selected
- Supports Single, Burst, Sequential, Idle and Repeat Transfer modes
- Data can be transferred in word or byte units
- Activation: internal interrupt, external request, auto-request

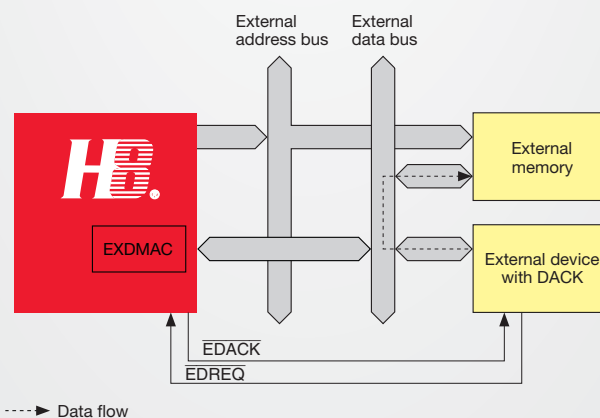
### DMA Controller Block Diagram



### Data Transfer Controller: Chain Transfer Mode



### ExDMA Controller Block Diagram



## ■ Analog Interfaces

- 4- to 16-channel 10-bit successive-approximation A/D converter (ADC)
- 2-channel, 14-bit delta-sigma ADC
- 2- to 4-channel 8-bit D/A converter

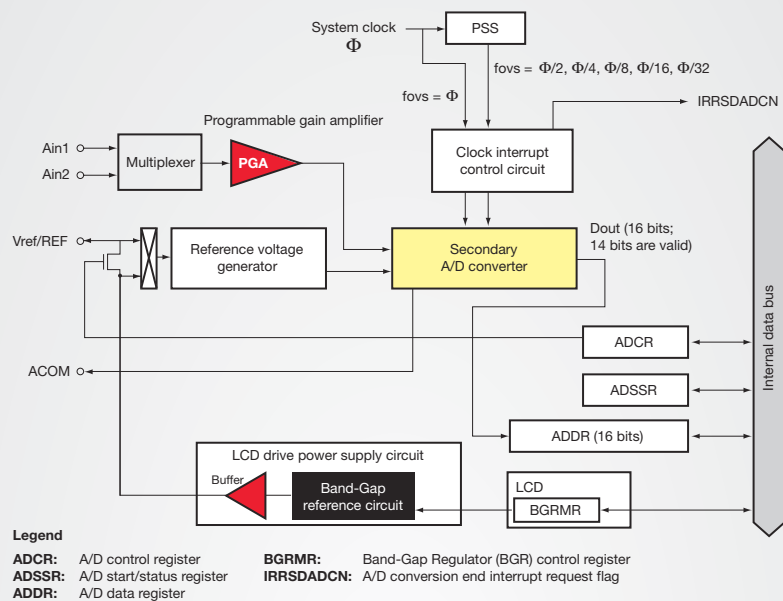
## ■ Timers

- Rich suite of 8-bit and 16-bit multifunction, multipurpose timers
  - Input capture, output compare, auto reload, event counter, up/down counter, interval timer, and sleep mode timer
- 3-phase Motor Control Timer
  - 2-phase encoder with up/down count capability
  - Suitable for motor control apps
- Asynchronous Event Counter (AEC)
  - Counts events even when system clock is disabled for power saving
- Watchdog timer (WDT) with independent RC circuit for greater safety
- 10-bit or 14-bit Pulse Width Modulation (PWM) timer with ripple-reduction feature
  - Can be used as a D/A converter by adding an external low-pass filter
- Real-Time Clock (RTC): seconds, minutes, hours, days and weeks

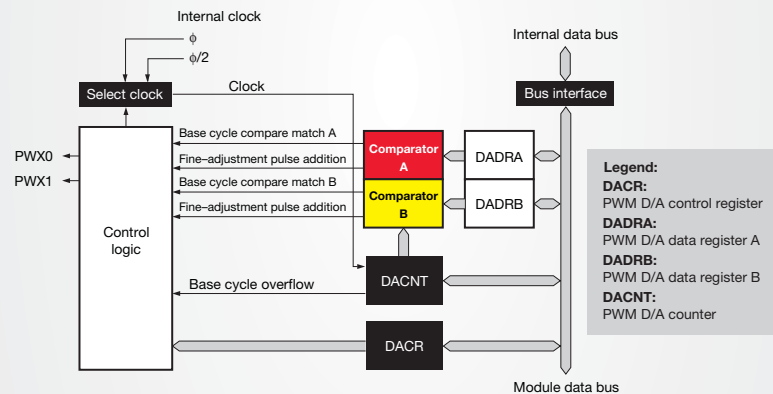
## ■ Arbitrary Waveform Generation / Programmable Pulse Generator (PPG) / Timing Pattern Controller (TPC)

- Arbitrary waveform patterns are stored in memory and generated on output pins with the PPG or TPC in conjunction with a timer and DMA
- Provides 8/16-bit programmable pulse outputs using TPU as base
- Output trigger signals can be selected in 4-bit groups
- Each group can operate both simultaneously and independently
- Output trigger signals can operate in parallel with DTC and DMAC

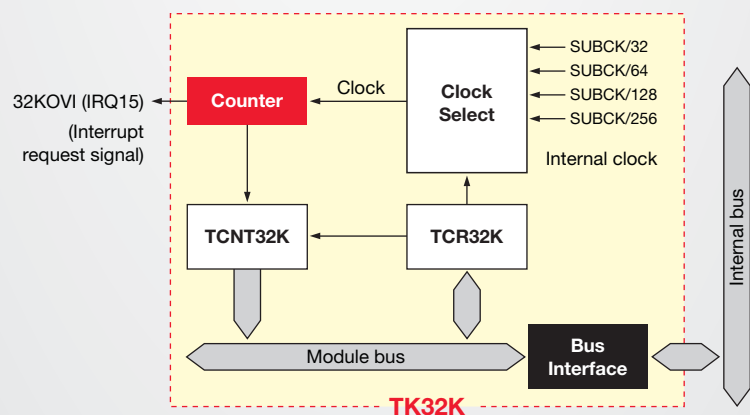
### H8/38086 14-bit Delta-Sigma A/D



### H8/Tiny 14-Bit PWM Timer Block Diagram



### H8S 32K Sleep Mode Timer Block Diagram



### ■ Low-Pin-Count (LPC) Interface

- A popular interface to communicate to PC chip set used in notebooks and PC servers
- Performs serial data and address transfer using 33MHz clock
- Supports I/O read and write cycles
- Supports serial interrupt on single line
- Supports power-down mode
- Reduced pin count

### ■ Host Interface X-Bus Interface

- Enables connection to the ISA (X-BUS)
- Four channel parallel interface
- Five host interrupt requests

### ■ Keyboard Buffer Controller (KBC)

- Conforms to PS/2 specification
- Error detection, parity error and stop bit monitoring
- Five host interrupt requests

### ■ PC Break Controller (PBC)

- Simplifies program debugging
- Instruction and data compare

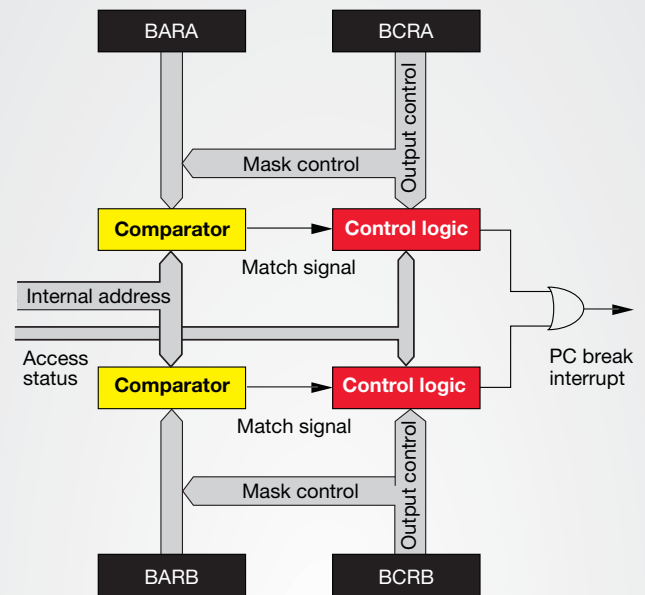
### ■ Dual-Tone Multi-Frequency (DTMF) Generator

- Generates DTMF frequency sine waveform, with minimum distortion
- Synthesis of single waveform

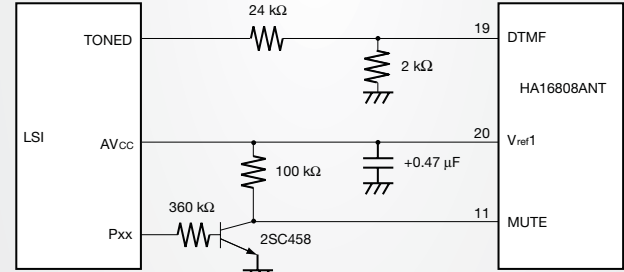
### ■ On-chip Bus Controller (BSC)

- Provides glueless interface with external devices
- Supports basic SRAM, burst-ROM interface
- Manages external, addressable 16MB region (8 different areas)
- Bus specification can be set independently for each region
- Selectable 8- or 16-bit bus width
- Choice of 0 to 7 programmable wait-state access
- Supports direct connection to SDRAM on selected devices
- Includes a bus arbiter for bus mastership arbitration

### PC Break Controller Block Diagram

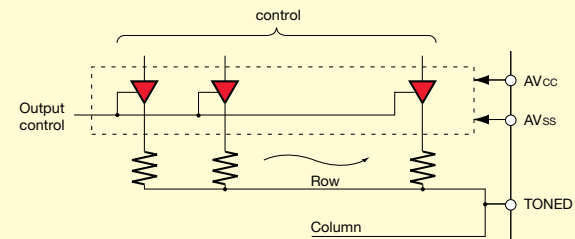


### DTMF Application Usage



Note: The numeric values on the right end of the signal lines indicate the HA16808ANT pin numbers.

### TONED Pin Output Equivalent Circuit



- Burst ROM interface can be set for area 0
- External write cycle and internal access can be executed in parallel
- Idle-cycle insertion capability

## ■ Overview

Renesas and the many third-party suppliers in the H8 community provide a wide range of hardware and software tools and other support services. Renesas offers products that cover all stages of the development of embedded systems that use H8 microcontrollers.

- **Evaluation**—Low-cost or no-cost Renesas tools make it easy to discover the capabilities of H8 MCUs and test the problem-solving power of the tools themselves, including the High-performance Embedded Workshop (HEW) integrated software development and debugging environment. A freely downloadable evaluation version of HEW lets you evaluate the ability of the Renesas C/C++ compiler to generate efficient code, and evaluation boards enable you to immediately test that code on known working hardware. In addition, the Renesas Interactive online engineering laboratory lets you use your own PC to get hands-on experience with powerful software and hardware tools and experiment with MCUs before purchase.
- **Debugging**—When you begin working on the design of your system, you can develop code using the full, unlimited compiler in exactly the same HEW environment. To track down bugs, use Renesas' on-chip and full in-circuit emulators, which have powerful specialized debugging hardware for trapping specific conditions and recording program activity.
- **Final Programming**—Use Renesas' Flash Development Toolkit, which has an easy-to-use interface, to program your debugged application into any of the many H8 MCUs that incorporate Renesas' mature on-chip flash memory technology.

All the tools required for developing H8-based applications are available from Renesas distributors. These tools have been developed by groups within the worldwide Renesas organization, experienced engineers who have access to the designers of the devices themselves. Their insight and expertise ensures the best possible tool performance and support.

## ■ Software

### Renesas' integrated development environment

The High-performance Embedded Workshop (or HEW) is a graphical development environment for C/C++ compiler toolchains with an industry-standard look and feel. Through the use of menus, toolbars, status bars, dockable windows and context-sensitive local menus, HEW integrates key capabilities that can help you create and manage your embedded microcontroller software projects. Its capabilities include:

- Project creation and editing
- Graphical configuration of compiler tools
- Project Make
- Debugging
- Version control

HEW provides enhanced functionality and an integrated instruction simulator that allows you to debug application code even when hardware isn't available. Also, the C/C++ compiler toolchains bundled with HEW generate code that executes faster and/or takes less memory space on Renesas microcontrollers.

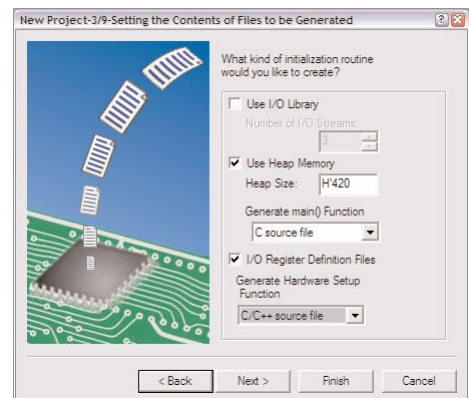
### One familiar interface, many functions

You can quickly learn the powerful tools you need for developing application code, and you have easy-to-use control over those tools.

Moreover, you can work with an interface that remains consistent across the entire range of Renesas MCUs and MPUs for greater efficiency. The interface is also highly customizable, so you can create an even more efficient environment for developing your application.

### Wizards simplify start-up processes

You can start projects fast by taking advantage of HEW's Project Generator "Wizards." Let them guide you through the selection of configuration options, debugger targets, and the creation of startup code.



## HEW Integrated Development Environment

### Project Manager

- Graphical control of compiler/linker options
- Function browser
- Drag and drop code templates
- Built-in (or external) project make

### Output Window

- Shows messages from build and find-in-files
- Linked to source in editor
- Version-control log

### Built-in Editor

- Syntax-sensitive coloring
- Multiple files open at once
- Source-level debugging

### Full Bus Trace

### Local Variable Watch

### C/C++ Variable Watch

### Stack Trace

### Complex Break Conditions

### Memory View

- Highlights changed values

### Virtual Desktop

- Allows multiple screen layouts to be recalled at the click of a button

## New features to help optimize your application code

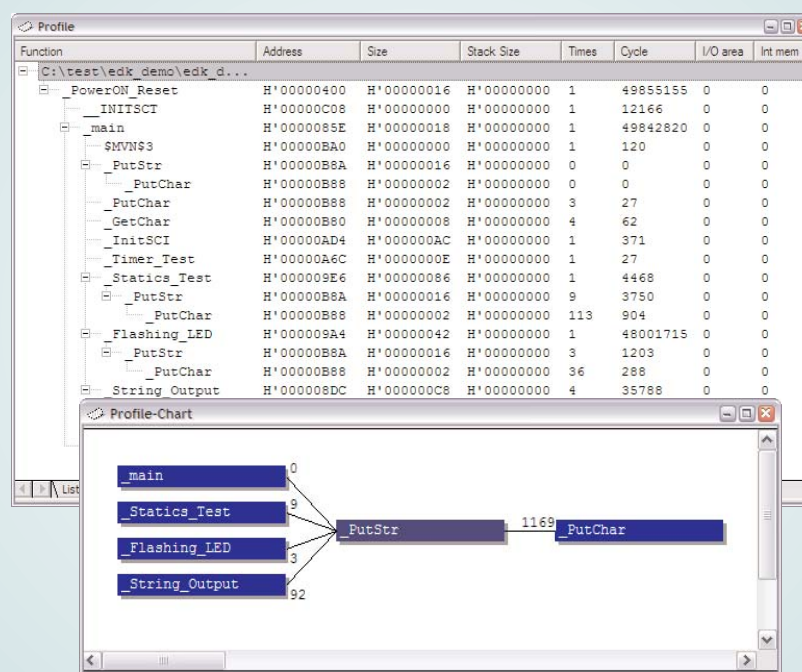
The integrated simulator/debugger has specific features and windows for testing the application code produced in the build process:

- Code profiling window (includes statistical and graphical displays)
- Performance analysis
- Code Coverage window
- Macro recorder and test case analysis

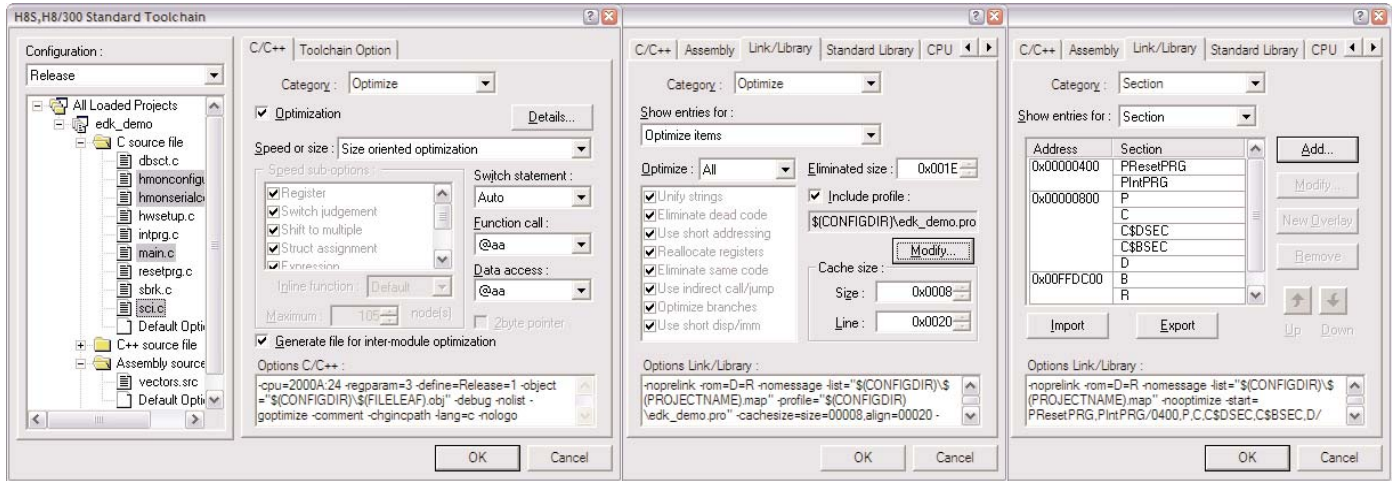
Additional analysis tools help you understand the operation and architecture of your embedded system application:

- Call Walker stack-trace analyzer
- Link Map file viewer

## HEW Profile Tree and Chart views



## HEW Compiler Toolchain Options Dialogs



### ■ Software (continued)

#### Optimized C/C++ code generation toolchains

The Renesas compiler toolchains (compiler, assembler and linker) support the full C++ language specification and are backward compatible with C. They have extensions for complete embedded system control directly from C, without requiring the use of any assembler code. These extensions cover:

- Interrupt service routines
- Condition control register operations
- Sleep instruction
- Pseudo functions for instructions such as multiply-and-accumulate and decimal add and subtract
- Control of the optimized addressing and function call features of the device architecture and instruction set

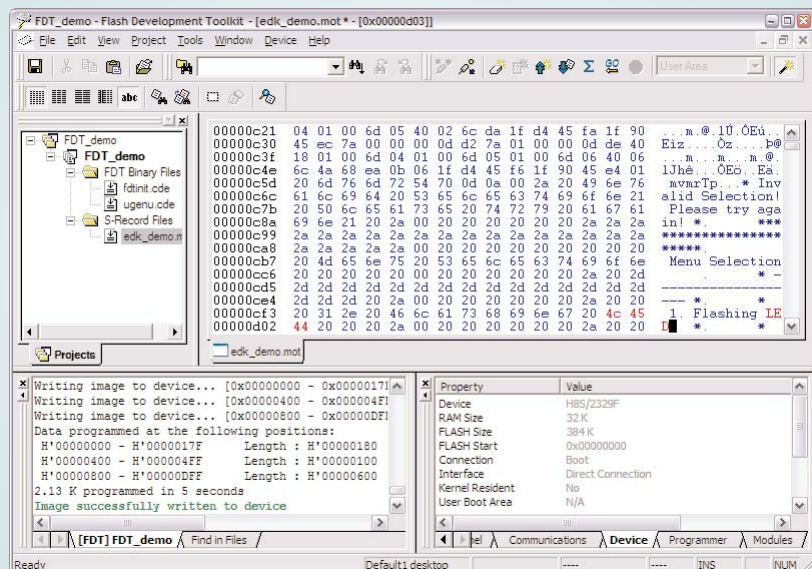
The inter-module optimizing linker produces optimized software load modules by performing global optimizations on your application.

#### Free evaluation HEW download

The flexible licensing technology in Renesas' compiler toolchains means you can download a free evaluation copy of HEW with the compiler and generate unlimited code for 60 days. This is very useful for benchmarking optimization efficiency and architecture performance. After 60 days, code

size is limited to 64 Kbytes, which still allows you to evaluate the architecture or experiment with peripherals. For smaller devices, you can even complete a full application, since the evaluation version is identical to the full version with the exception of the code-size limits, including all optimization options.

#### Flash Development Toolkit



### HEW Integrated Debugging

Modular debug target support is provided directly within the HEW environment so you can build your application and debug without leaving HEW. A debug session wizard allows you to easily add a new debug target to your workspace. Examples include:

- Instruction Simulator
- In-Circuit Emulators
  - E6000 series emulator
  - Compact emulator
- On-chip Emulators
  - E10A emulator
  - E8 emulator
- Evaluation boards using a ROM-resident monitor

### Flash Development Toolkit

Renesas' Flash Development Toolkit (FDT) is an easy-to-use utility for programming your code into the on-chip flash memory of H8 MCUs. You can create workspaces to combine several s-record files into one download image and save connection settings to easily manage device programming.

#### FDT offers:

- Direct USB connection for USB boot mode devices
- Serial communication at up to 115,200 baud
- Hex image editor
- Extensive messaging that helps hardware development
- Support for programming via E8 USB debugger

### ■ Hardware

#### Evaluation and Development Kits

Renesas' low-cost Evaluation and Development Kits (EDKs) are inexpensive ways to experience the performance of H8 microcontrollers. Each kit comes complete with an EDK board and a CD-ROM that contains:

- An evaluation version of the High-performance Embedded Workshop (HEW), C/C++ compilers and a debug link to a resident monitor.
- The Flash Development Toolkit (FDT)

The CD included in the EDK also has a Quick-Start guide that shows how to install the software and contains full documentation with sample tutorials and a tutorial Project Generator plug-in for HEW.

#### H8 StarterKit Plus [SKP...] & Renesas Starter Kits [RSK...]

These kits bundle a low-cost target board with the E8 on-chip debug emulator and the evaluation version of the HEW IDE to offer an



integrated evaluation and development platform that lets you get up and running quickly with the H8 family. The E8 provides a foolproof connection to the host IDE and can also power the target board without the need for an external power supply.

#### E8 and E10A-USB on-chip emulators

The E8 and E10A-USB emulators are designed to connect with Renesas' H8 Tiny and JTAG



## ■ Hardware (continued)

on-chip debugging interfaces, respectively. These low-cost tools provide real-time debugging on the target device, using the dedicated debugging resources built into the target microcontroller in your user hardware. The on-chip emulators connect to the target system via an interface that can be used both to debug the system and to program the MCU's on-chip flash memory.

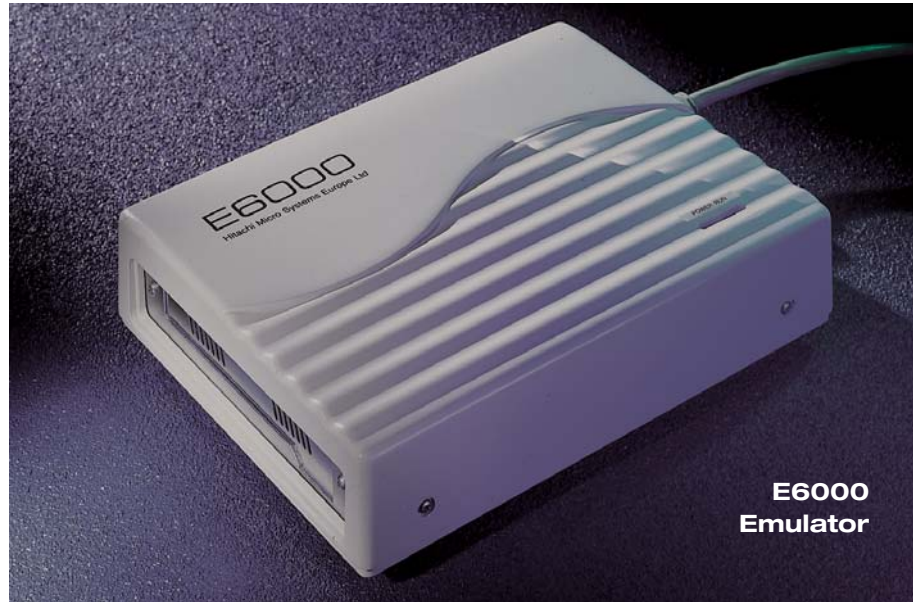
The E8 and E10A-USB emulators use plug-and-play USB 2.0 compatible interfaces for easy connection to both notebook computers and desktop machines. These emulators offer:

- 255 PC breakpoints
- Hardware breakpoints on data and address
- Saved record of last 4 branches
- On-chip flash programming
- Integrated debugging support in HEW

### Compact Emulators for H8 Tiny Series MCUs

For users who require full in-circuit emulation, but not the expanded resources of a traditional ICE, the compact emulator provides a superior cost-performance ratio in an extremely compact design. The emulator main unit comes in a significantly reduced size, compared with conventional emulator systems, allowing easier connection to target systems.

Although being affordable in price, it has all the basic functions needed for real development, such as access to all of the devices, pins and



memory map as well as real-time trace and hardware breaks.

- Includes HEW integrated development and debugging environment and evaluation copy of C/C++ compiler tools.
- Supplied as a package including the target cable and PCB adaptor.

### E6000/E6000H in-circuit emulators

Renesas' E6000 series comprises a range of advanced real-time in-circuit emulators, each of which supports a family of processors. You can use the emulators as totally self-contained solutions for software development and debugging, or connect them via a custom cable to a target system for debugging your hardware. These powerful debugging tools provide:

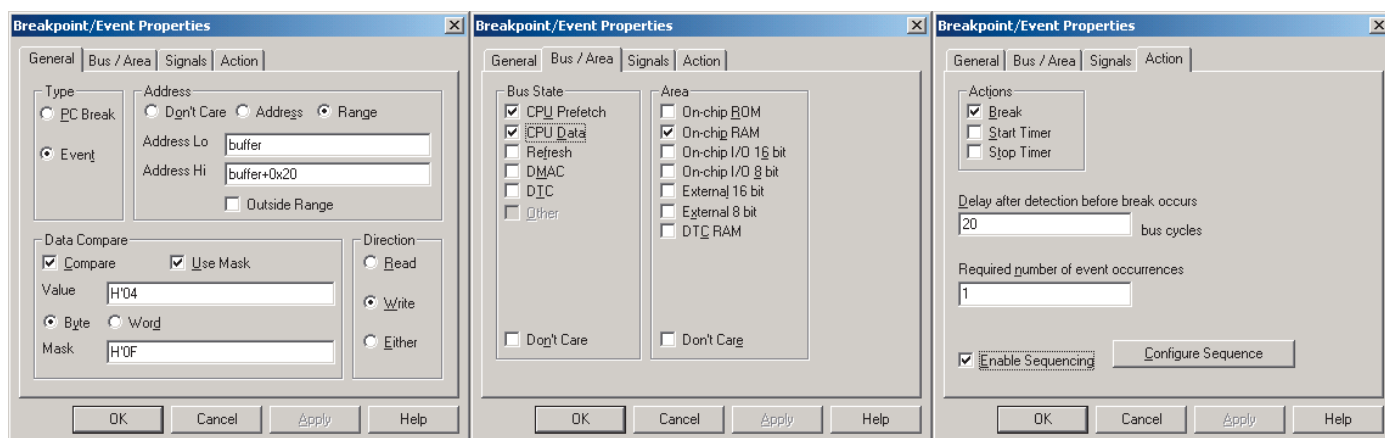
- Zero wait-state, non-intrusive real-time emulation (E6000 < 33MHz, E6000H < 66MHz)
- Emulation memory from 1MB to 4MB, which can be mapped into the target processor's address space

- 256 PC breakpoints
- Trace Buffer of up to 32K cycles, which can be stopped and read during program execution
- Trace buffer acquisition filtering using the Complex Event System
- Post-acquisition trace filtering and search facility
- Automatic tracking of the target system supply voltage to ensure that the emulator draws no power
- Multiple target clock selection
- Integrated debugging support in HEW

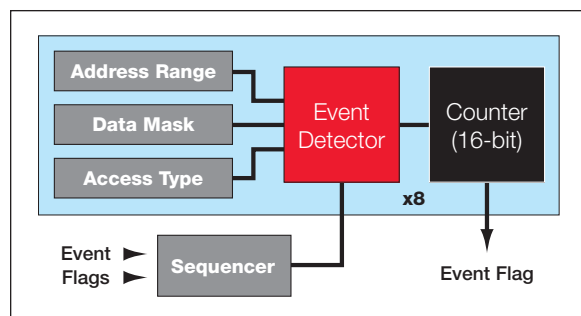
### E6000 Complex Event System

The debugging power of the E6000 comes from the Complex Event System (CES), a sophisticated mechanism that lets you specify exactly the set of conditions you want to examine. Break, trace or timing functions are activated using Event and Range channels. You control the CES from the HEW environment.

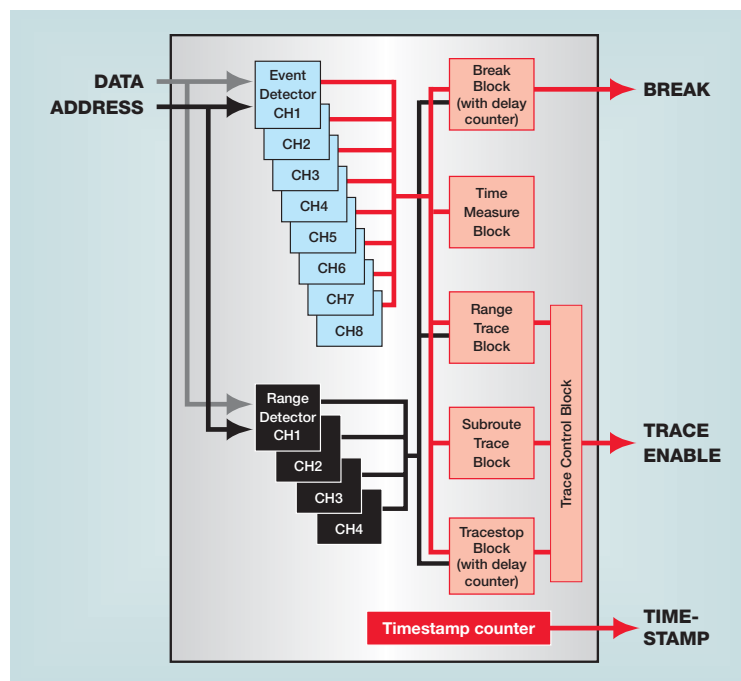
## Specify exact conditions for an Event



## Complex Event System (CES) Event Block



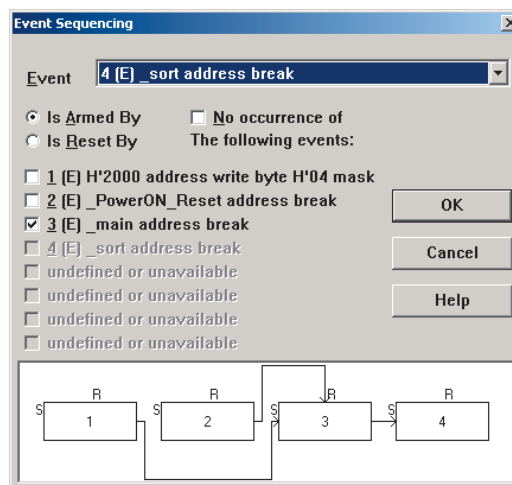
## Combine Events logically and sequentially for precise control



The Complex Event System offers:

- Up to 12 hardware breakpoints using the Event and Range channels
- Execution time measurement of total time or relative time, with a resolution of 20ns to 16µs
- Four user logic probes that can be used as CES trigger events and trace data

Events may be combined to define a complex sequence of conditions/actions. An event sequence defines a list of events, where each event may be activated or deactivated by the occurrence of another. Up to eight events can be sequenced to generate an action. The event sequencer gives you such flexible control over the CES that practically any development problem can be trapped and investigated.



Event Sequencing dialog gives a graphical view of Complex Event System logic

## In-Circuit Emulator Selection

Choosing the components required to complete a full emulation system for a device can be a complicated task, due to specific device support and package variations. The Renesas website provides a useful tool to aid in selecting the required components.

### Easy Instructions:

1 Go to the Renesas web site and browse to an emulator product page.

2 Click on the **Options** link in the navigation menu to open the selection search.

3 Select the emulator type in the “Tool Name” menu and then the required Family, Series and Group. Click “Display Results” for a list of the required components.

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**E6000**

- Specifications
- System Configuration (LAN)
- System Configuration (PCI)
- System Configuration (PCMCIA)
- USB System Configuration
- Application Notes
- Documentation
- Downloads
- FAQs
- Options →
- Technical Update

**Renesas Technology - Microsoft Internet Explorer**

Address: http://america.renesas.com/request

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**Tool Name :** E6000

Family : H8S Family Series : H8S/2300 Series Group : H8S/2329 Group

**Display results**

note : Search for options to E6000. Please select a device and click "Display results". For details, see at the following the Accessory Guide. <http://tool-support.renesas.com/eng/accessories/index.html>

**H8S Family**

ON THIS PAGE:

- H8S/2300 Series
- H8S/2329 Group

**H8S/2329 Group** [Top](#)

**H8S/2300 Series H8S/2329 Group FP-128**

Recommended products

|                                                      | Product name | Mass produced | Under development | Discontinued | Option Included | Note                                                                                                          |
|------------------------------------------------------|--------------|---------------|-------------------|--------------|-----------------|---------------------------------------------------------------------------------------------------------------|
| Emulator Type Number                                 | HS2339EP61H  | x             |                   |              |                 |                                                                                                               |
| Memory Board                                         | HS6000EMS12H | x             |                   |              | x               | 4MB Expanded Memory                                                                                           |
| User interface cable or User interface board         | HS2328ECH61H | x             |                   |              |                 |                                                                                                               |
| IC socket (connect to target system)                 | NQPACK128RD  | x             |                   |              | x               | Tokyo Eletech Co., Ltd. (One socket is attached to the user interface board or user interface cable product.) |
| Host System Interface (at least one interface board) | HS6000EIP02H | x             |                   |              |                 | PCMCIA Interface HS6000EIP01H has shifted to HS6000EIP02H.                                                    |
|                                                      | HS6000EIC02H | x             |                   |              |                 | PCI Interface                                                                                                 |
|                                                      | HS6000ELN01H | x             |                   |              |                 | LAN Interface                                                                                                 |
|                                                      | HS6000EIV02H | x             |                   |              |                 | USB Interface                                                                                                 |

**H8S/2300 Series H8S/2329 Group PTQP0120LA-A \*Previous code : TFP-120**

Recommended products

|                                              | Product name      | Mass produced | Under development | Discontinued | Option Included | Note                                                                                                        |
|----------------------------------------------|-------------------|---------------|-------------------|--------------|-----------------|-------------------------------------------------------------------------------------------------------------|
| Emulator Type Number                         | HS2339EP61H       | x             |                   |              |                 |                                                                                                             |
| Memory Board                                 | HS6000EMS12H      | x             |                   |              | x               | 4MB Expanded Memory                                                                                         |
| User interface cable or User interface board | HS2328ECN61H      | x             |                   |              |                 |                                                                                                             |
| IC socket (connect to target system)         | IC149-120-043-B51 | x             |                   |              | x               | Yamaichi Electronics Co., Ltd. (One socket is attached to the user interface board or user interface cable) |

## H8 Family Development Tool Selector

| Series  | Group      | Catalog Part Number | Renesas Package Code | Starter Kit     | On-chip Debug Emulator | Compact Emulator                         | Full Emulator                    |                             |                            | IDE (C Compiler)* |
|---------|------------|---------------------|----------------------|-----------------|------------------------|------------------------------------------|----------------------------------|-----------------------------|----------------------------|-------------------|
|         |            |                     |                      |                 |                        | Compact Emulator (including PCB Adaptor) | Base Unit including PC Interface | Personality Kit (Pod/Probe) | PCB Adaptor (Target Cable) |                   |
| SLP     | H8/38602R  | HD64F38602RFT4V     | PVQN0032KA-A         | SKP38602        | R0E000080KCE00         | -                                        | -                                | -                           | -                          | RTA-HEWH8-1U      |
|         | H8/38004   | HD64F38004H4V       | PRQP0064GB-A         | SKP38024        | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS3800EBK61H                | HS3802ECH61H               | RTA-HEWH8-1U      |
|         | H8/38024   | HD64F38024RHV       | PRQP0080JB-A         | SKP38024        | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS3800EBK61H                | HS38024ECH61H              | RTA-HEWH8-1U      |
|         | H8/3827    | HD64F38324HV        | PRQP0080JB-A         | R0K438347S000BE | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS388REBK61H                | HS3864ECH61H               | RTA-HEWH8-1U      |
|         | H8/3827    | HD64F38327HV        | PRQP0080JB-A         | R0K438347S000BE | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS388REBK61H                | HS3864ECH61H               | RTA-HEWH8-1U      |
|         | H8/3847    | HD64F38344HV        | PRQP0100KA-A         | R0K438347S000BE | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS388REBK61H                | HS3887ECH61H               | RTA-HEWH8-1U      |
|         | H8/3847    | HD64F38347HV        | PRQP0100KA-A         | R0K438347S000BE | R0E000080KCE00         | -                                        | HS38000EPI61H                    | HS388REBK61H                | HS3887ECH61H               | RTA-HEWH8-1U      |
|         | H8/38076R  | HD64F38076RH4V      | PRQP0080JB-A         | 3DK38076        | R0E000080KCE00         | -                                        | -                                | -                           | -                          | RTA-HEWH8-1U      |
| H8/Tiny | H8/38086R  | HD64F38086RH4V      | PRQP0080JB-A         | 3DK38086R       | R0E000080KCE00         | -                                        | -                                | -                           | -                          | RTA-HEWH8-1U      |
|         | H8/36912   | HD64F36912GFHV      | PLQP0032GC-A         | SKP36912        | R0E000080KCE00         | -                                        | HS3664EPI62H                     | -                           | HS36902ECH61H              | RTA-HEWH8-1U      |
|         | H8/36014   | HD64F36012GFPV      | PLQP0064KC-A         | SKPH8TINY       | R0E000080KCE00         | R0E436640CPE20                           | HS3664EPI62H                     | -                           | HS36014ECH61H              | RTA-HEWH8-1U      |
|         | H8/36014   | HD64F36014GFPV      | PLQP0064KC-A         | SKPH8TINY       | R0E000080KCE00         | R0E436640CPE20                           | HS3664EPI62H                     | -                           | HS36014ECH61H              | RTA-HEWH8-1U      |
|         | H8/36064   | HD64F36064GHV       | PRQP0064GB-A         | SKPH8TINY       | R0E000080KCE00         | R0E436640CPE10                           | HS3664EPI62H                     | -                           | HS3687ECH62H               | RTA-HEWH8-1U      |
|         | H8/36094   | HD64F36094XXX       | PVQN0048KA-A         | SKPH8TINY       | R0E000080KCE00         | -                                        | HS3664EPI62H                     | -                           | HS36014ECN61H              | RTA-HEWH8-1U      |
|         | H8/36077   | HD64F36074GHV       | PRQP0064GB-A         | EDK3687         | R0E000080KCE00         | -                                        | HS3664EPI62H                     | -                           | HS3687ECH62H               | RTA-HEWH8-1U      |
|         | H8/36077   | HD64F36077GHV       | PRQP0064GB-A         | EDK3687         | R0E000080KCE00         | -                                        | HS3664EPI62H                     | -                           | HS3687ECH62H               | RTA-HEWH8-1U      |
| H8S     | H8/36087   | HD64F36087FPV       | PLQP0064KC-A         | EDK3687         | R0E000080KCE00         | R0E436640CPE20                           | HS3664EPI62H                     | -                           | HS3687ECH61H               | RTA-HEWH8-1U      |
|         | H8/36049   | HD64F36049GHV       | PRQP0080JB-A         | EDK3687         | R0E000080KCE00         | R0E436049CPE10                           | HS3664EPI62H                     | HS36024EIO61H               | HS36049ECH61H              | RTA-HEWH8-1U      |
|         | H8S/2168   | HD64F2168VTE33V     | PTQP0144LC-A         | 3DK2166         | HS0005KCU01H           | -                                        | HS6000EIO02H                     | HS2168EPI61H                | HS2168ECN61H               | RTA-HEWH8-1U      |
|         | H8S/2168   | HD64F2167VTE33V     | PTQP0144LC-A         | 3DK2166         | HS0005KCU01H           | -                                        | HS6000EIO02H                     | HS2168EPI61H                | HS2168ECN61H               | RTA-HEWH8-1U      |
|         | H8S/2168   | HD64F2166VTE33V     | PTQP0144LC-A         | 3DK2166         | HS0005KCU01H           | -                                        | HS6000EIO02H                     | HS2168EPI61H                | HS2168ECN61H               | RTA-HEWH8-1U      |
|         | H8S/2212   | HD64F2211UFP24V     | PLQP0064KC-A         | 3DK2218         | HS0005KCU01H           | -                                        | HS2214EPI62H-U                   | -                           | HS2212ECH61H               | RTA-HEWH8-1U      |
|         | H8S/2212   | HD64F2212UFP24V     | PLQP0064KC-A         | 3DK2218         | HS0005KCU01H           | -                                        | HS2214EPI62H-U                   | -                           | HS2212ECH61H               | RTA-HEWH8-1U      |
|         | H8S/2218   | HD64F2218UTF24V     | PTQP0100LC-A         | 3DK2218         | HS0005KCU01H           | -                                        | HS2214EPI62H-U                   | HS6000EMS12H                | HS2218ECN61H               | RTA-HEWH8-1U      |
|         | H8S/2215   | HD64F2215UTE16V     | PTQP0120LA-A         | EDK2215         | -                      | -                                        | HS2214EPI62H-U                   | HS6000EMS12H                | HS2215RECN61H              | RTA-HEWH8-1U      |
|         | H8S/2215   | HD64F2215RUTE24V    | PTQP0120LA-A         | R0K42215RS000BE | HS0005KCU01H           | -                                        | HS2214EPI62H-U                   | HS6000EMS12H                | HS2215RECN61H              | RTA-HEWH8-1U      |
|         | H8S/2238R  | HD64F2238RFA6V      | PRQP0100KA-A         | EDK2239         | -                      | -                                        | E62633R                          | -                           | EH2238Q100B                | RTA-HEWH8-1U      |
|         | H8S/2239   | HD64F2239FA20V      | PRQP0100KA-A         | EDK2239         | -                      | -                                        | HS2214EPI62H-U                   | HS6000EMS12H                | HS2238ECH61H               | RTA-HEWH8-1U      |
|         | H8S/2317BL | HD64F2317VTEBL25V   | PTQP0100KA-A         | EDK2329         | HS0005KCU01H           | -                                        | E62339                           | -                           | EH2318Q100B                | RTA-HEWH8-1U      |
|         | H8S/2319   | HD64F2318VTE25V     | PTQP0100KA-A         | EDK2329         | HS0005KCU01H           | -                                        | E62339                           | -                           | EH2318Q100B                | RTA-HEWH8-1U      |
|         | H8S/2327BL | HD64F2327BVFB25V    | PRQP0128KB-A         | EDK2329         | HS0005KCU01H           | -                                        | E62339                           | -                           | EH2328Q128                 | RTA-HEWH8-1U      |
|         | H8S/2368   | HD64F2367VTE33V     | PTQP0120LA-A         | EDK2378         | HS0005KCU01H           | -                                        | E62678R                          | -                           | EH2678RQ144                | RTA-HEWH8-1U      |
|         | H8S/2368   | HD64F2368VTE34V     | PTQP0120LA-A         | EDK2378         | HS0005KCU01H           | -                                        | E62678R                          | -                           | EH2678RQ144                | RTA-HEWH8-1U      |
|         | H8S/2378R  | HD64F2378R VFQ34V   | PLQP0144KC-A         | EDK2378         | HS0005KCU01H           | -                                        | E62678R                          | -                           | EH2678RQ144                | RTA-HEWH8-1U      |
|         | H8S/2633   | HD64F2633RF28V      | PRQP0128KB-A         | EDK2638         | -                      | -                                        | E62633R                          | -                           | EH2633Q128                 | RTA-HEWH8-1U      |
| H8SX    | H8SX/1653  | RSF61653N50FTV      | PTQP0120LA-A         | R0K561664S000BE | HS0005KCU01H           | -                                        | HS6000EIO02H                     | HS1650EPH60H                | HS1653ECN61H               | RTA-HEWH8-1U      |

For more information on tool accessories or different packages, please go to Renesas' tools website.

\* Multi-user and floating network licenses available; see website for details.

## Third-party Development Tools

Many third-party experts offer hardware and software development tools supported by design services, RTOS, compilers, board-level solutions, custom firmware, and board-support packages (BSPs) to meet the needs of customers developing H8-based products.

**IAR Systems** offers a consistent IDE that supports nearly all MCU targets in the industry. The environment includes MISRA C support with integrated CSpy debugging, E8 and E10A-USB support and Elf/Dwarf debug output (compatible with HEW for debugging with full ICE). In addition, IAR offers RTOS-aware debugging

with plug-ins for Micrium µC/OS-II, OSEK (ORTI) and Segger embOS. [www.iar.com](http://www.iar.com)

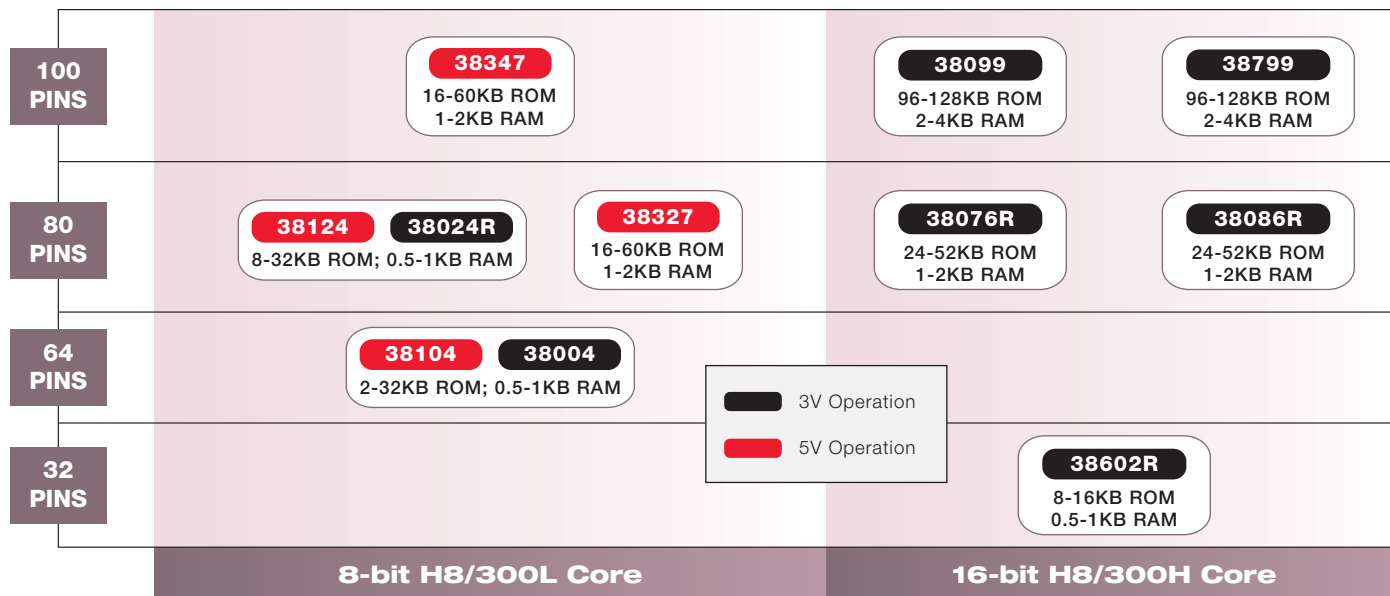
**Segger Microcontroller Systems** provides a small and efficient real-time kernel embOS with graphical GUI and file system libraries. [www.segger.com](http://www.segger.com)

**KPIT Cummins Infosystems** provides free-of-charge maintenance and support for GNU compiler tools, including installers that integrate the GCC toolchain into the HEW IDE and allow use with Renesas debuggers and emulators. [www.kpitgnutools.com](http://www.kpitgnutools.com)

For more details about 3rd party support, please visit: <http://america.renesas.com/toolspartners>



## H8 Super Low Power Series Line-up



### ■ Features

- Multiple techniques minimize power consumption and extend battery life
  - Low-power CMOS technology for 1.8V operation
  - Up to 9 Low-power modes
  - 32 kHz on-chip sub-clock oscillator
  - Peripheral-independent standby mode
- Advanced analog interfaces such as 14-bit Delta-Sigma converter
- Shorter oscillation stabilization time lets applications wake up faster from standby mode, conserving power
- LCD controller with built-in voltage booster circuit eliminates need for external DC/DC converter
- High current port for driving LEDs directly
- 16-bit asynchronous counter (AEC) operates even when device is in standby mode
- Low cost development tools using on-chip debug

### ■ Applications

**Metering:** Electric, gas and water meters

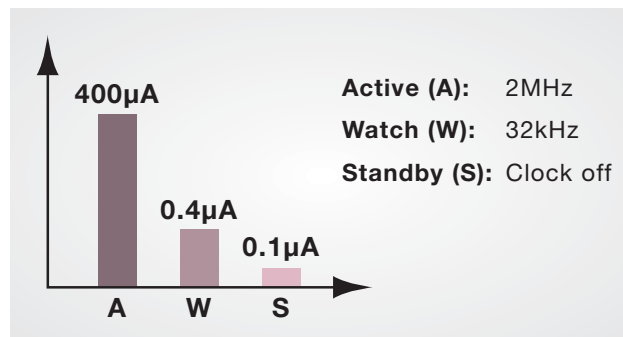
**Medical:** Glucose meters, heart-rate monitors, thermometers, weight scales

**Security:** Intrusion detection systems, smoke detectors, fire alarms

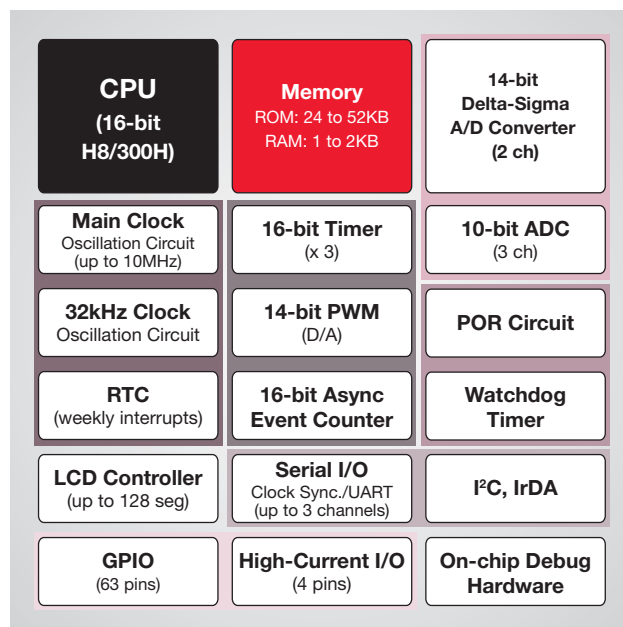
**Consumer:** Refrigerators, washer/dryers, remote controllers, dehumidifiers, thermostats, lawn sprinkler timers

**Computing:** Remotely updatable displays, remote actuators

### Typical Power Consumption (@ 1.8V, 25°C)



### H8/38086R Block Diagram



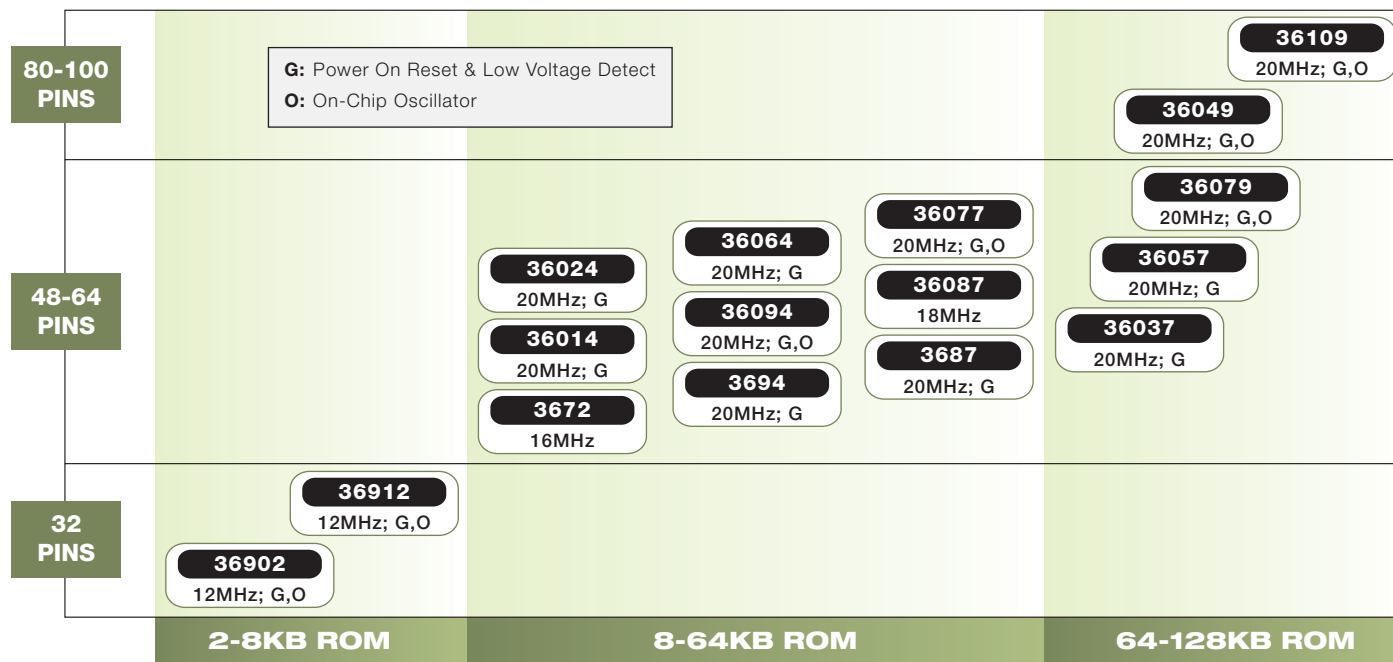
## H8 Super Low Power Series Selector Guide

|                    | Group                                                                | Catalog<br>Part Number                                                                                                               | Flash<br>(Kbytes)                            | Mask ROM Option (Kbytes) (See Note 1) | RAM (Kbytes)                                                                                            | Vcc Min<br>Vcc Max<br>Max Input MHz @ Vcc Max<br>32 kHz Sub Clock (See Note 6)<br>Power Down Modes |                                                      |                                          |                                                      | Timers                                                                               |                                        |                                      |                                                                                          | Serial I/F (Sync/Async)<br>LCD Controller<br>A/D 10-bit Resolution<br>GPIO (See Note 2]<br>(High Current) (See Note 3)<br>Extended Temperature (See Note 4) |                                          |                                          |                                                                  | Special<br>Features                          | Package Code: Part No.Suffix (See Note 5)                                       |                                                       |                                                       |                                                                             |                  |                  |                    |                    |                  |                  |                  |                   |        |        |        |        |        |        |        |        |        |        |
|--------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|------------------|------------------|--------------------|--------------------|------------------|------------------|------------------|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                    |                                                                      |                                                                                                                                      |                                              |                                       |                                                                                                         |                                                                                                    |                                                      |                                          |                                                      | 8-bit Timers                                                                         | 16-bit Timers                          | Watchdog Timers                      | 14-bit PWM Serial I/F (Sync/Async)                                                       |                                                                                                                                                             |                                          |                                          |                                                                  |                                              | PLQP0064KC-A : FP                                                               | PLQP0100KB-A : F                                      | PRQP0064GB-A : H                                      | PRQP0080GD-B : F                                                            | PRQP0080JB-A : H | PRQP0100KA-A : H | PTLG0085JA-A : LPV | PTLG0113JA-A : LGV | PTQP0080KC-A : W | PTQP0100KA-A : X | PTQP0100LC-A : W | PVQN0032KA-A : FT |        |        |        |        |        |        |        |        |        |        |
| 8-bit H8/300L Core | H8/38327                                                             | HD64F38324<br>HD64F38327                                                                                                             | 32<br>60                                     | 16-60                                 | 2<br>2                                                                                                  | 2.7<br>2.7                                                                                         | 5.5<br>5.5                                           | 16<br>16                                 | Y 8<br>Y 8                                           | 3 1 1 1<br>3 1 1 1                                                                   | 1 1 1 1<br>1 1 1 1                     | 2<br>2                               | 32x4<br>8 64 (8)<br>8 64 (8)                                                             | Y<br>Y                                                                                                                                                      | 16-bit AEC                               | -<br>-                                   | -<br>-                                                           | -<br>-                                       | -<br>Y                                                                          | -<br>-                                                | -<br>-                                                | -<br>-                                                                      | -<br>Y           | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>-           | -<br>-           | -<br>-            | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |        |        |        |        |
|                    | H8/38347                                                             | HD64F38344<br>HD64F38347                                                                                                             | 32<br>60                                     | 16-60                                 | 2<br>2                                                                                                  | 2.7<br>2.7                                                                                         | 5.5<br>5.5                                           | 16<br>16                                 | Y 8<br>Y 8                                           | 3 1 1 1<br>3 1 1 1                                                                   | 1 1 1 1<br>1 1 1 1                     | 3<br>3                               | 40x4<br>12 84 (16)<br>12 84 (16)                                                         | Y<br>Y                                                                                                                                                      | 16-bit AEC,                              | -<br>-                                   | -<br>-                                                           | -<br>-                                       | -<br>Y                                                                          | -<br>-                                                | -<br>-                                                | -<br>-                                                                      | -<br>-           | -<br>Y           | -<br>Y             | -<br>Y             | -<br>Y           | -<br>Y           | -<br>Y           | -<br>Y            | -<br>Y | -<br>Y | -<br>Y | -<br>Y |        |        |        |        |        |        |
|                    | H8/38004                                                             | HD64F38002FP10<br>HD64F38002FP4<br>HD64F38002H10<br>HD64F38002H4<br>HD64F38004FP10<br>HD64F38004FP4<br>HD64F38004H10<br>HD64F38004H4 | 16<br>16<br>16<br>16<br>32<br>32<br>32<br>32 | 8-32                                  | 1<br>1<br>1<br>1<br>1<br>1<br>1<br>1                                                                    | 2.7<br>2.2<br>2.7<br>2.2<br>2.7<br>2.2<br>2.7<br>2.2                                               | 3.6<br>3.6<br>3.6<br>3.6<br>3.6<br>3.6<br>3.6<br>3.6 | 10<br>4<br>10<br>4<br>10<br>4<br>10<br>4 | Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7 | 1 1 1 1<br>1 1 1 1<br>1 1 1 1<br>1 1 1 1<br>1 1 1 1<br>1 1 1 1<br>1 1 1 1<br>1 1 1 1 | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-   | 1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 | 25x4<br>4 50 (6)<br>4 50 (6)<br>4 50 (6)<br>4 50 (6)<br>4 50 (6)<br>4 50 (6)<br>4 50 (6) | Y<br>-<br>Y<br>-<br>Y<br>-<br>Y<br>-                                                                                                                        | 16-bit AEC,<br>2-ch 10-bit PWM           | Y<br>Y<br>-<br>Y<br>Y<br>-<br>Y<br>-     | -<br>-                                                           | -<br>-                                       | -<br>Y                                                                          | -<br>-                                                | -<br>-                                                | -<br>-                                                                      | -<br>-           | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>-           | -<br>-           | -<br>-            | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |        |        |        |
|                    |                                                                      | H8/38104                                                                                                                             | HD64F38102<br>HD64F38104                     |                                       | 16<br>32                                                                                                | 8-32                                                                                               | 1<br>1                                               | 2.7<br>2.7                               | 5.5<br>5.5                                           | 20<br>20                                                                             | Y 7<br>Y 7                             | 1 1 1 1<br>1 1 1 1                   | -<br>-                                                                                   | 1<br>1                                                                                                                                                      | 25x4<br>4 49 (12)<br>4 49 (12)           | Y<br>Y                                   | 16-bit AEC,<br>2-ch 10-bit PWM,<br>POR, LVD                      | Y<br>Y                                       | -<br>Y                                                                          | -<br>Y                                                | -<br>-                                                | -<br>-                                                                      | -<br>-           | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>-           | -<br>-           | -<br>-            | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |        |        |        |
|                    |                                                                      | H8/38024R                                                                                                                            | HD64F38024R                                  |                                       | 32                                                                                                      | 8-32                                                                                               | 1                                                    | 2.7                                      | 3.6                                                  | 10                                                                                   | Y 8                                    | 3 1 1 1                              | -                                                                                        | 1                                                                                                                                                           | 32x4<br>8 66 (6)                         | Y                                        | 16-bit AEC, 2-ch<br>10-bit PWM                                   | -                                            | -                                                                               | -                                                     | Y                                                     | Y                                                                           | -                | -                | -                  | Y                  | -                | Y                | -                | -                 | -      | -      | -      | -      | -      | -      |        |        |        |        |
|                    |                                                                      | H8/38124                                                                                                                             | HD64F38122<br>HD64F38124                     |                                       | 16<br>32                                                                                                | 8-32                                                                                               | 1<br>1                                               | 2.7<br>2.7                               | 5.5<br>5.5                                           | 20<br>20                                                                             | Y 8<br>Y 8                             | 3 1 1 1<br>3 1 1 1                   | -<br>-                                                                                   | 1<br>1                                                                                                                                                      | 32x4<br>8 65 (14)<br>8 65 (14)           | Y<br>Y                                   | 16-bit AEC,<br>2-ch 10-bit PWM,<br>POR, LVD                      | -<br>-                                       | -<br>-                                                                          | -<br>-                                                | -<br>Y                                                | -<br>-                                                                      | -<br>-           | -<br>-           | -<br>Y             | -<br>-             | -<br>-           | -<br>-           | -<br>-           | -<br>-            | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |        |        |        |
|                    |                                                                      |                                                                                                                                      | H8/38076R                                    |                                       | HD64F38076RH10<br>HD64F38076RH4<br>HD64F38076RLP10<br>HD64F38076RLP4<br>HD64F38076RW10<br>HD64F38076RW4 |                                                                                                    | 52<br>52<br>52<br>52<br>52<br>52                     | 24-48                                    | 2<br>2<br>2<br>2<br>2<br>2                           | 2.7<br>1.8<br>2.7<br>1.8<br>2.7<br>1.8                                               | 3.6<br>3.6<br>3.6<br>3.6<br>3.6<br>3.6 | 10<br>4<br>10<br>4<br>10<br>4        | Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7                                                   | - 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1                                                                                              | 2<br>2<br>2<br>2<br>2<br>2               | 3<br>3<br>3<br>3<br>3<br>3               | 32x4<br>8 63 (4)<br>8 63 (4)<br>8 63 (4)<br>8 63 (4)<br>8 63 (4) | Y<br>Y<br>Y<br>Y<br>Y<br>Y                   | RTC, 16-bit AEC,<br>IrDA, I <sup>2</sup> C, POR                                 | -<br>-<br>-<br>-<br>-<br>-                            | -<br>-                                                | -<br>-                                                                      | -<br>-           | -<br>-           | -<br>Y             | -<br>-             | -<br>-           | -<br>-           | -<br>Y           | -<br>-            | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |
|                    |                                                                      | H8/38086R                                                                                                                            |                                              |                                       | HD64F38086RH10<br>HD64F38086RH4<br>HD64F38086RLP10<br>HD64F38086RLP4<br>HD64F38086RW10<br>HD64F38086RW4 | 52<br>52<br>52<br>52<br>52<br>52                                                                   | 24-48                                                |                                          | 2<br>2<br>2<br>2<br>2<br>2                           | 2.7<br>1.8<br>2.7<br>1.8<br>2.7<br>1.8                                               | 3.6<br>3.6<br>3.6<br>3.6<br>3.6<br>3.6 | 10<br>4<br>10<br>4<br>10<br>4        | Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7<br>Y 7                                                   | - 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1<br>- 3 1 1                                                                                              | 2<br>2<br>2<br>2<br>2<br>2               | 3<br>3<br>3<br>3<br>3<br>3               | 32x4<br>3 63 (4)<br>3 63 (4)<br>3 63 (4)<br>3 63 (4)<br>3 63 (4) | Y<br>-<br>Y<br>-<br>Y<br>-                   | RTC,<br>16-bit AEC,<br>IrDA,<br>2-ch 14-bit<br>ΔΣ ADC,<br>I <sup>2</sup> C, POR | -<br>-<br>-<br>-<br>-<br>-                            | -<br>-                                                | -<br>-                                                                      | -<br>-           | -<br>-           | -<br>Y             | -<br>-             | -<br>-           | -<br>-           | -<br>Y           | -<br>-            | -<br>- | -<br>- | -<br>Y | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |
|                    |                                                                      |                                                                                                                                      |                                              |                                       | H8/38099                                                                                                | HD64F38099FP4<br>HD64F38099FP10<br>HD64F38099LG4V<br>HD64F38099LG10V                               |                                                      |                                          | 128<br>128<br>128<br>128                             | 96-128                                                                               | 4<br>4<br>4<br>4                       | 1.8<br>2.7<br>1.8<br>2.7             | 3.6<br>3.6<br>3.6<br>3.6                                                                 | 4<br>10<br>4<br>10                                                                                                                                          | Y 7<br>Y 7<br>Y 7<br>Y 7                 | 2 3 1 1<br>2 3 1 1<br>2 3 1 1<br>2 3 1 1 | 4<br>4<br>4<br>4                                                 | 4<br>4<br>4<br>4                             | 40x4<br>8 83 (4)<br>8 83 (4)<br>8 83 (4)                                        | Y<br>Y<br>Y<br>Y                                      | RTC,<br>16-bit AEC,<br>IrDA, I <sup>2</sup> C,<br>POR | -<br>-<br>-<br>-                                                            | Y<br>Y<br>-      | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>-           | -<br>Y           | -<br>-            | -<br>- | -<br>- | -<br>Y | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |
| H8/38799           | HD64F38799FP4<br>HD64F38799FP10<br>HD64F38799LG4V<br>HD64F38799LG10V |                                                                                                                                      |                                              | 128<br>128<br>128<br>128              |                                                                                                         | 96-128                                                                                             |                                                      |                                          | 4<br>4<br>4<br>4                                     |                                                                                      | 1.8<br>2.7<br>1.8<br>2.7               | 3.6<br>3.6<br>3.6<br>3.6             | 4<br>10<br>4<br>10                                                                       | Y 7<br>Y 7<br>Y 7<br>Y 7                                                                                                                                    | 2 3 1 1<br>2 3 1 1<br>2 3 1 1<br>2 3 1 1 | 4<br>4<br>4<br>4                         | 4<br>4<br>4<br>4                                                 | 8 83 (4)<br>8 83 (4)<br>8 83 (4)<br>8 83 (4) | Y<br>Y<br>Y<br>Y                                                                | RTC,<br>16-bit AEC,<br>IrDA, I <sup>2</sup> C,<br>POR | -<br>-<br>-<br>-                                      | Y<br>Y<br>-                                                                 | -<br>-           | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>Y           | -<br>-           | -<br>-            | -<br>- | -<br>Y | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- |        |
|                    | H8/38602R                                                            |                                                                                                                                      |                                              | HD64F38602RFT10<br>HD64F38602RFT4     |                                                                                                         |                                                                                                    |                                                      |                                          | 16<br>16                                             |                                                                                      | 8-16                                   | 1<br>1                               | 2.7<br>1.8                                                                               | 3.6<br>3.6                                                                                                                                                  | 10<br>4                                  | Y 7<br>Y 7                               | 1 1 1 1<br>1 1 1 1                                               | -<br>-                                       | 1<br>1                                                                          | 6 19 (3)<br>6 19 (3)                                  | Y<br>Y                                                | RTC, 16-bit AEC,<br>IrDA, I <sup>2</sup> C, 2-ch<br>comparator,<br>SSU, POR | -<br>-           | -<br>-           | -<br>-             | -<br>-             | -<br>-           | -<br>-           | -<br>-           | -<br>-            | -<br>- | -<br>Y | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>- | -<br>Y | -<br>Y |

## Notes:

1. Please refer to the Hardware Manual for the operating voltage of Mask ROM devices.
2. This is the sum of the I/O pins + input-only + output-only.
3. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
4. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
5. Full part number includes **Package Suffix** for desired package. Refer to Appendix C for more details on part numbering.
6. Y = Yes, includes 32kHz crystal oscillator circuitry.

## H8 Tiny Series Line-up



### Features

- High performance 16-bit CPU, with eight 32-bit general-purpose registers and 32-bit data processing
- Up to 20MHz operation
- On-chip flash for simplified production programming or code update
- Flexible clocking scheme with multiple clock sources and multiple levels of clock dividers
- Various 8- and 16-bit timers for advanced waveform generations typically used in motor control applications
- Multiple fail-safe features such as watchdog timers with dedicated on-chip oscillator, external oscillator fail detection, low-voltage detection and Reset source detection
- High current port for driving LEDs directly
- High peripheral integration, including real-time clock, up to sixteen A/D channels and a range of communication interfaces
- System cost reduction with built-in power-on reset circuitry, band-gap voltage regulators and on-chip oscillators
- Low-cost development tools using on-chip debug
- Code and peripheral function compatibility with other H8 microcontroller families

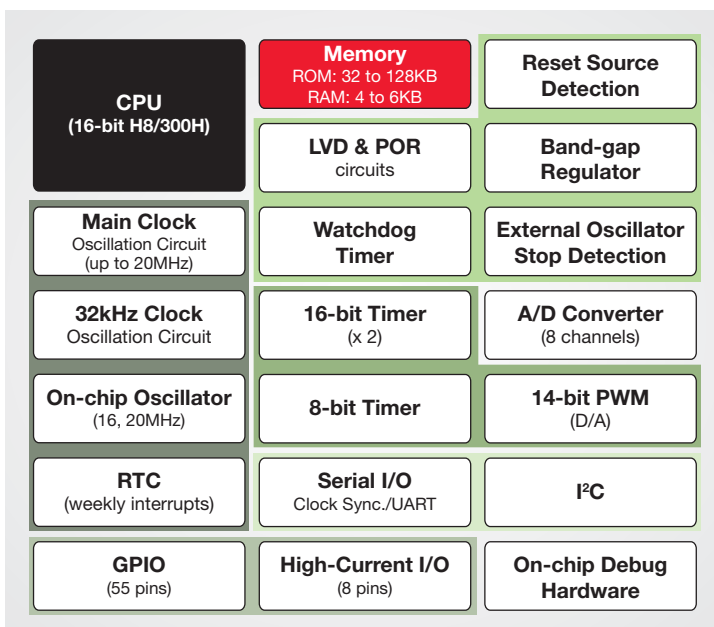
### Applications

**Consumer:** White goods (refrigerators, washer/dryers, cooking ranges, etc.), home electronics, game pads, vacuum cleaners

**Industrial:** HVAC systems, thermostats, controllers for small DC brushless motors, stepper motors

**Office Automation:** Mechanical controls for fax, printers, measurement devices

### 36077, 36079 Block Diagram



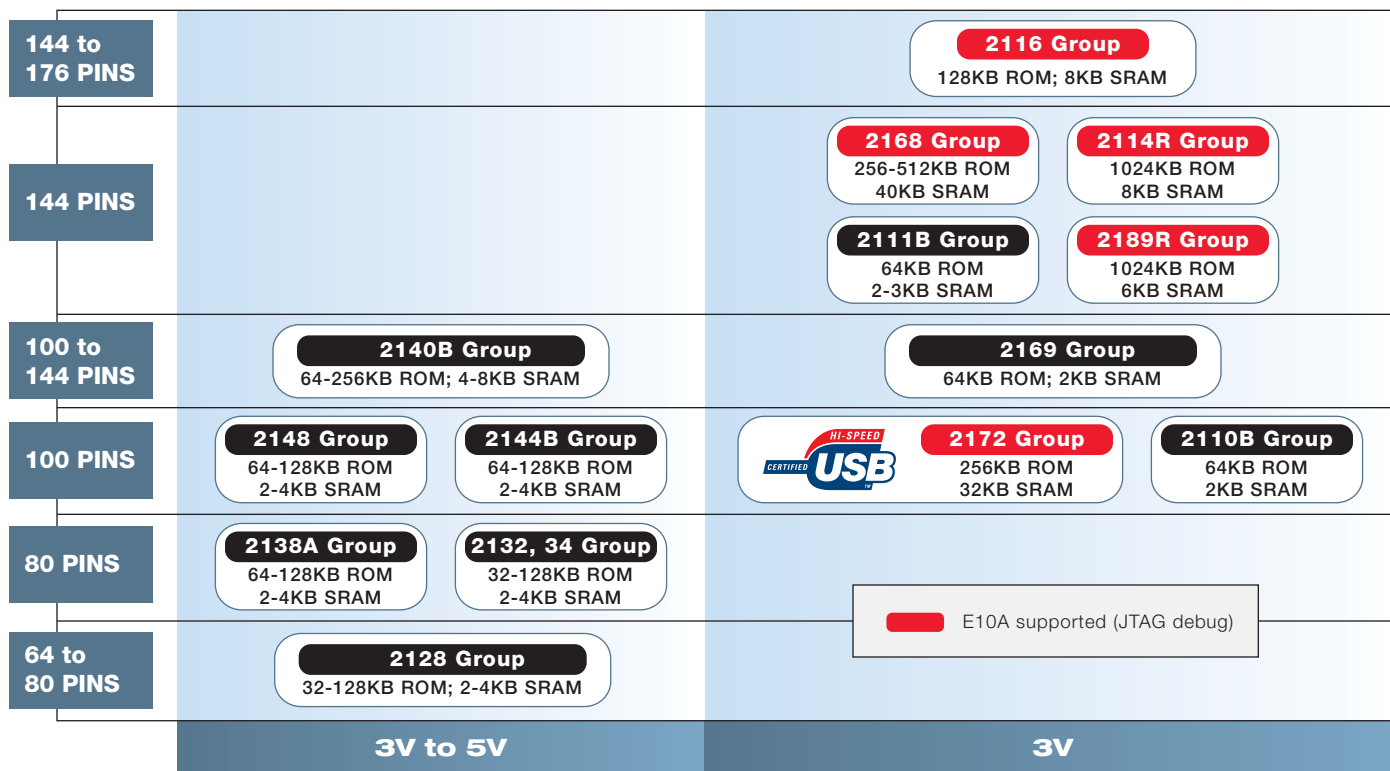
## H8 Tiny Series Selector Guide

| Group    | Catalog Part Number | Flash (Kbytes) | Mask ROM Options (Kbytes) (See Note 1) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | 32 kHz Sub Clock (See Note 6) | Timers       |               |                 |                | Serial I/F                                  |                  | A/D 10-bit Resolution | POR and LVD | On-chip Debug | GPIO (See Note 2)<br>(High current) (See Note 3)<br>Extended Temperature (See Note 4) | Special Features | Package Code : Part No.Suffix (See Note 5) |                     |                  |                  |                  |                 |                 |                  |                  |                  |                   |                   |   |   |   |   |   |   |
|----------|---------------------|----------------|----------------------------------------|--------------|---------|---------|-------------------|-------------------------------|--------------|---------------|-----------------|----------------|---------------------------------------------|------------------|-----------------------|-------------|---------------|---------------------------------------------------------------------------------------|------------------|--------------------------------------------|---------------------|------------------|------------------|------------------|-----------------|-----------------|------------------|------------------|------------------|-------------------|-------------------|---|---|---|---|---|---|
|          |                     |                |                                        |              |         |         |                   |                               | 8-bit Timers | 16-bit Timers | Watchdog Timers | 14-bit PWM D/A | Serial (Sync Async)<br>SSU (SPI Compatible) | I <sup>2</sup> C |                       |             |               |                                                                                       |                  | PLP0032GC-A : FH                           | PLP0045JA-A : FX    | PLP0048KC-A : FY | PLP0064KB-A : FZ | PLP0064KC-A : FP | PLP0100KB-A : F | PRP0032BB-A : P | PRQP0064GB-A : H | PRQP0080JB-A : H | PRQP0100JE-B : F | PRSP0032DC-A : TP | PVQN0048KA-A : FT |   |   |   |   |   |   |
| H8/3672  | HD64F3670           | 8              | -                                      | 2            | 3.0     | 5.5     | 16                | -                             | 1            | 1             | 1               | -              | 1                                           | -                | -                     | 4           | -             | Y                                                                                     | 30 (5)           | Y                                          | -                   | Y                | Y                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - |   |   |   |   |   |
|          | HD64F3672           | 16             | -                                      | 2            | 3.0     | 5.5     | 16                | -                             | 1            | 1             | 1               | -              | 1                                           | -                | -                     | 4           | -             | Y                                                                                     | 30 (5)           | Y                                          | -                   | Y                | Y                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - |   |   |   |   |   |
| H8/3687  | HD64F3684           | 32             | 16-56                                  | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          | RTC, WDTO           | -                | -                | -                | -               | Y               | -                | -                | -                | -                 | -                 | - | - |   |   |   |   |
|          | HD64F3684G          | 32             |                                        | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | -               | Y               | -                | -                | -                | -                 | -                 | - | - |   |   |   |   |
|          | HD64F3687           | 56             |                                        | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | -               | Y               | -                | -                | -                | -                 | -                 | - | - |   |   |   |   |
|          | HD64F3687G          | 56             |                                        | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | -               | Y               | -                | -                | -                | -                 | -                 | - | - |   |   |   |   |
| H8/3694  | HD64F3694           | 32             | 8-32                                   | 2            | 3.0     | 5.5     | 20                | Y                             | 2            | 1             | 1               | -              | 1                                           | -                | 1                     | 8           | -             | Y                                                                                     | 37 (8)           | Y                                          | WDTO                | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | Y |   |   |   |
|          | HD64F3694G          | 32             |                                        | 2            | 3.0     | 5.5     | 20                | Y                             | 2            | 1             | 1               | -              | 1                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 37 (8)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | Y |   |   |   |
| H8/36014 | HD64F36012          | 16             | 8-32                                   | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 2                                           | -                | -                     | 4           | -             | Y                                                                                     | 34 (5)           | Y                                          | WDTO                | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
|          | HD64F36012G         | 16             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 2                                           | -                | -                     | 4           | Y             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
|          | HD64F36014          | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 2                                           | -                | -                     | 4           | -             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
|          | HD64F36014G         | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 2                                           | -                | -                     | 4           | Y             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
| H8/36024 | HD64F36022          | 16             | 16-32                                  | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 3                                           | -                | -                     | 4           | -             | Y                                                                                     | 34 (5)           | Y                                          | WDTO                | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | - | Y |   |
|          | HD64F36022G         | 16             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 3                                           | -                | -                     | 4           | Y             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
|          | HD64F36024          | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 3                                           | -                | -                     | 4           | -             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
|          | HD64F36024G         | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 1            | 1             | 1               | -              | 3                                           | -                | -                     | 4           | Y             | Y                                                                                     | 34 (5)           | Y                                          |                     | -                | Y                | Y                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | Y |   |   |
| H8/36037 | HD64F36034          | 32             | 16-56                                  | 2            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 1                                           | 1                | -                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          | OCO, WDTO, CAN, SST | -                | -                | -                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - | - |
|          | HD64F36034G         | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 1                                           | 1                | -                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
|          | HD64F36037          | 56             |                                        | 3            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 1                                           | 1                | -                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
|          | HD64F36037G         | 56             |                                        | 3            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 1                                           | 1                | -                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36057 | HD64F36054          | 32             | 32-56                                  | 2            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 2                                           | 1                | -                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          | OCO, WDTO, CAN, SST | -                | -                | -                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - | - |
|          | HD64F36054G         | 32             |                                        | 2            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 2                                           | 1                | -                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
|          | HD64F36057          | 56             |                                        | 3            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 2                                           | 1                | -                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
|          | HD64F36057G         | 56             |                                        | 3            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | -              | 2                                           | 1                | -                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36049 | HD64F36049HV        | 96             | 64-96                                  | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 3             | 1               | 1              | 3                                           | -                | 1                     | 8           | -             | Y                                                                                     | 67 (13)          | Y                                          | RTC, WDTO           | -                | -                | -                | -               | -               | -                | -                | -                | -                 | -                 | - | - | - | - | - |   |
|          | HD64F36049GHV       | 96             |                                        | 4            | 3.0     | 5.5     | 20                | Y                             | 2            | 3             | 1               | 1              | 3                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 67 (13)          | Y                                          |                     | -                | -                | -                | -               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36064 | HD64F36064G         | 32             | -                                      | 2            | 3.0     | 5.5     | 20                | -                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 53 (8)           | Y                                          | WDTO                | -                | -                | -                | -               | Y               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36077 | HD64F36074G         | 32             | -                                      | 4            | 4.5     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 55 (8)           | Y                                          | OCO, RTC, WDTO      | -                | -                | -                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - | - |
|          | HD64F36077G         | 56             |                                        | 4            | 4.5     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 55 (8)           | Y                                          |                     | -                | -                | -                | Y               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36079 | HD64F36079G         | 128            | -                                      | 6            | 4.5     | 5.5     | 20                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 55 (8)           | Y                                          | OCO, RTC, WDTO      | -                | -                | -                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - |   |
| H8/36094 | HD64F36094          | 32             | -                                      | 2            | 3.0     | 5.5     | 20                | Y                             | 2            | 1             | 1               | -              | 1                                           | -                | 1                     | 8           | -             | Y                                                                                     | 39 (8)           | Y                                          | OCO, WDTO           | -                | Y                | Y                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - |   |
|          | HD64F36094G         | 32             |                                        | 2            | 4.5     | 5.5     | 20                | Y                             | 2            | 1             | 1               | -              | 1                                           | -                | 1                     | 8           | Y             | Y                                                                                     | 39 (8)           | Y                                          |                     | -                | Y                | Y                | Y               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - |   |   |
| H8/36087 | HD64F36067          | 56             | 16-56                                  | 4            | 3.0     | 3.6     | 18                | Y                             | 2            | 2             | 1               | 1              | 2                                           | -                | 1                     | 8           | -             | Y                                                                                     | 53 (8)           | Y                                          | RTC, WDTO           | -                | -                | -                | -               | Y               | -                | -                | -                | Y                 | -                 | - | - | - | - |   |   |
| H8/36109 | HD64F36109          | 128            | -                                      | 5            | 3.0     | 5.5     | 20                | Y                             | 2            | 3             | 1               | 1              | 3                                           | -                | 1                     | 16          | -             | Y                                                                                     | 87 (20)          | -                                          | OCO, RTC, BGR, WDTO | -                | -                | -                | -               | -               | Y                | -                | -                | -                 | -                 | - | - | - | - |   |   |
|          | HD64F36109G         | 128            |                                        | 5            | 3.0     | 5.5     | 20                | Y                             | 2            | 3             | 1               | 1              | 3                                           | -                | 1                     | 16          | Y             | Y                                                                                     | 87 (20)          | -                                          |                     | -                | -                | -                | -               | -               | Y                | -                | -                | -                 | -                 | - | - | - | - |   |   |
| H8/36902 | HD64F36902G         | 8              | 2-8                                    | 1.5          | 3.0     | 5.5     | 12                | -                             | 1            | 1             | 1               | -              | 1                                           | -                | -                     | 4           | Y             | Y                                                                                     | 22 (5)           | Y                                          | WDTO, OCO           | Y                | -                | -                | -               | -               | -                | -                | -                | Y                 | -                 | - | - | - | - | - |   |
| H8/36912 | HD64F36912G         | 8              | 4-8                                    | 1.5          | 3.0     | 5.5     | 12                | -                             | 2            | 1             | 1               | -              | 1                                           | -                | 1                     | 4           | Y             | Y                                                                                     | 22 (5)           | Y                                          |                     | -                | Y                | -                | -               | -               | -                | -                | -                | -                 | -                 | - | - | - | - |   |   |

## Notes:

1. Please refer to the Hardware Manual for the operating voltage of Mask ROM devices.
2. This is the sum of the I/O pins + input-only + output-only.
3. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
4. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
5. Full part number includes **Package Suffix** for desired package. Refer to Appendix C for more details on part numbering.
6. Y = Yes, includes 32kHz crystal oscillator circuitry.

## H8S/2100 Series Line-up



## ■ Features

- Up to 33MHz, low-power, 16-bit static core CPU
- 8 power-down modes for reducing power consumption
- Built-in Data Transfer Controller (DTC) with maximum of 85 channels
- Low-Pin-Count (LPC) bus interface synchronized with 33MHz PCI clock
- X-Bus (ISA) bus interface for legacy devices
- Multiple independent Inter IC (I<sup>2</sup>C™) two-wire serial bus interfaces
- IrDA interface for easy wireless connectivity
- 3-channel on-chip keyboard buffer controller conforming to PS/2 interface specification
- Built-in Bus Controller (BSC) for glueless basic bus or burst-ROM interface to external devices
- Fully integrated IPMI software available from Renesas partners
- Up to 16 PWM channels for multiple fan control

## ■ Applications

**Computing:** Enclosure management for servers and routers, IKAP

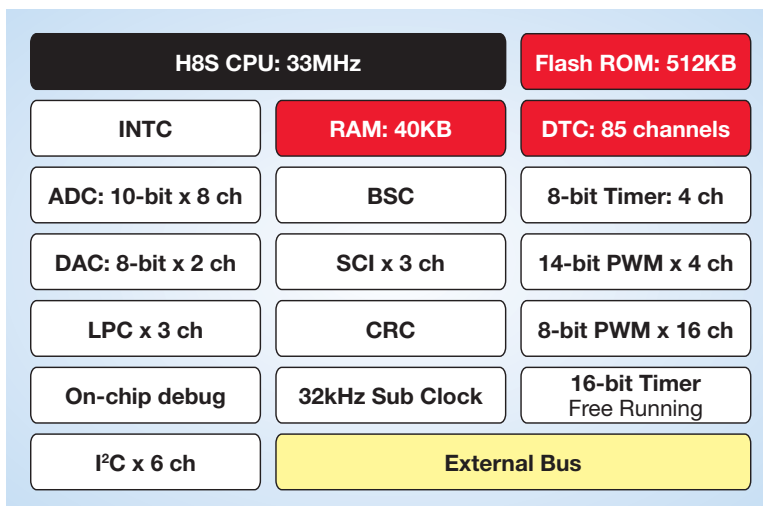
**Industrial:** HVAC, utility meters, GPS systems

**Automotive:** Controllers for safety systems, LCD backlight controllers

**Medical:** Controllers for health and fitness equipment

**Consumer:** Handheld products, appliances

## H8S/2166 Series Block Diagram



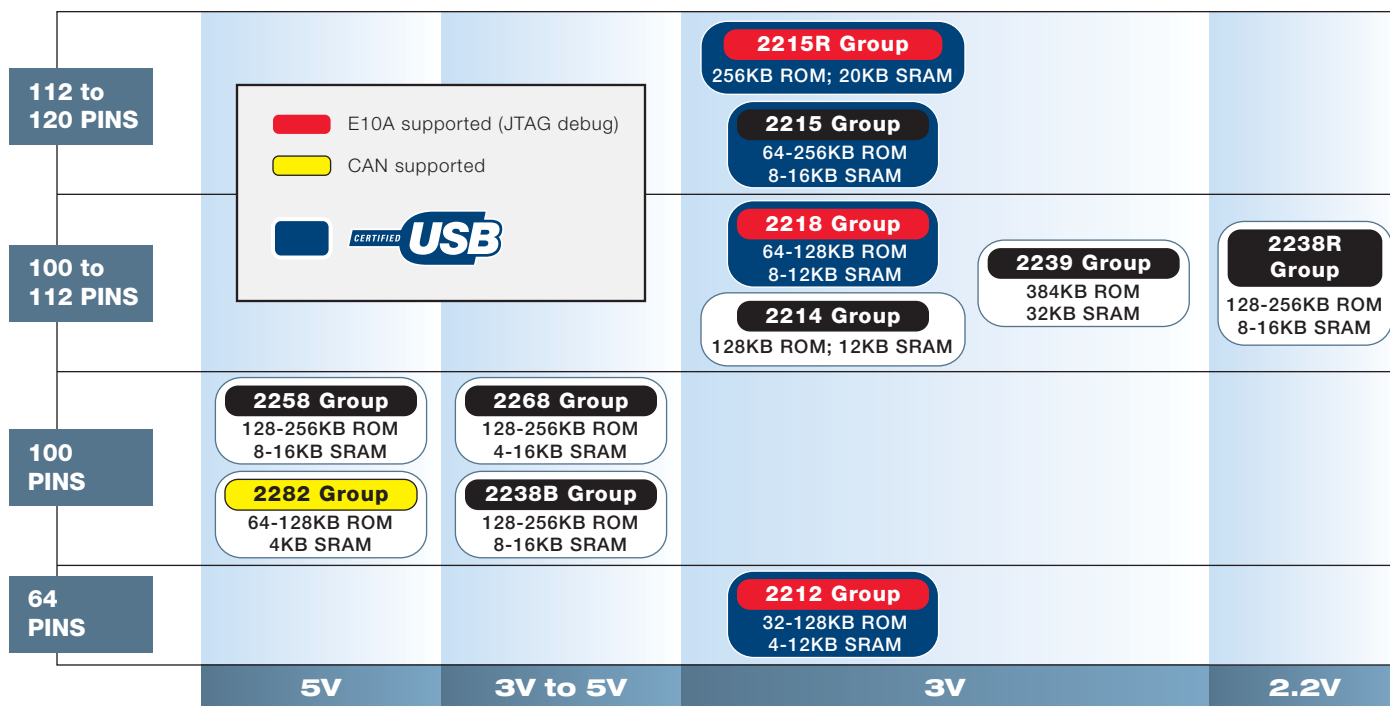
## H8S/2100 Series Selector Guide

| Group                                       | Catalog Part Number | Flash (Kbytes) | Mask ROM Options (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | 32 kHz Sub Clock (See Note 1) | Timers       |               |                 |           | Analog         |                       | Serial               |                 | DTC | DMA Channels | External Interrupts | GPIO [See Note 2]<br>(High Current) [See Note 3] | External Data Bus | Extended Temp. (See Note 4) | Special Features | Package Code |                                       |                                          |                                                                                                                                                                                                              |
|---------------------------------------------|---------------------|----------------|---------------------------|--------------|---------|---------|-------------------|-------------------------------|--------------|---------------|-----------------|-----------|----------------|-----------------------|----------------------|-----------------|-----|--------------|---------------------|--------------------------------------------------|-------------------|-----------------------------|------------------|--------------|---------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                             |                     |                |                           |              |         |         |                   |                               | 8-bit Timers | 16-bit Timers | Watchdog Timers | 8-bit PWM | 14-bit PWM D/A | A/D 10-bit Resolution | D/A 8-bit Resolution | Sync/Async IrDA |     |              |                     |                                                  |                   |                             |                  |              | Smart Card Interface I <sup>2</sup> C |                                          |                                                                                                                                                                                                              |
| H8S/2110B <sup>5</sup>                      | HD64F2110BVFA10     | 64             | -                         | 2            | 3.0     | 3.6     | 10                | in                            | 2            | 1             | 2               | -         | 2              | -                     | -                    | 1               | -   | -            | 2                   | -                                                | -                 | 31                          | 82 (6)           | -            | -                                     | KBD, LPC,<br>3 ch PS2, 5v IO             | PRQP0100KA-A<br>PTQP0100KA-A                                                                                                                                                                                 |
|                                             | HD64F2110BVTE10     | 64             | -                         | 2            | 3.0     | 3.6     | 10                | in                            | 2            | 1             | 2               | -         | 2              | -                     | -                    | 1               | -   | -            | 2                   | -                                                | -                 | 31                          | 82 (6)           | -            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2111B                                   | HD64F2111BVTE10B    | 64             | -                         | 2            | 3.0     | 3.6     | 10                | in                            | 6            | 1             | 2               | 8         | -              | 6                     | -                    | 1               | -   | -            | 2                   | -                                                | -                 | 31                          | 122 (6)          | -            | -                                     | KBD, LPC,<br>3 ch PS2, 5v IO             | PTQP0144LC-A<br>PTQP0144LC-A                                                                                                                                                                                 |
|                                             | HD64F2111BVTE10C    | 64             | -                         | 3            | 3.0     | 3.6     | 10                | in                            | 6            | 1             | 2               | 8         | -              | 6                     | -                    | 1               | -   | -            | 2                   | -                                                | -                 | 31                          | 122 (6)          | -            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2114                                    | R4F2114RVTE20V      | 1024           | -                         | 8            | 3.0     | 3.6     | 20                | in                            | 4            | 4             | 2               | 8         | 2              | 8                     | -                    | 2               | Y   | Y            | 2                   | Y                                                | -                 | 49                          | 119 (6)          | -            | -                                     | KBD, LPC, 3 ch PS2,<br>BSCAN, 5v IO,     | PTQP0144LC-A                                                                                                                                                                                                 |
| H8S/2116                                    | R4F2116VTE20V       | 128            | -                         | 8            | 3.0     | 3.6     | 20                | in                            | 4            | 3             | 2               | 8         | 2              | 16                    | -                    | 1               | -   | Y            | 3                   | -                                                | -                 | 41                          | 125 (40)         | Y            | -                                     | LPC, PS/2                                | PTQP0144LC-A                                                                                                                                                                                                 |
|                                             | R4F2116VBG20V       | 128            | -                         | 8            | 3.0     | 3.6     | 20                | in                            | 4            | 3             | 2               | 8         | 2              | 16                    | -                    | 1               | -   | Y            | 3                   | -                                                | -                 | 41                          | 125 (40)         | Y            | -                                     | LPC, PS/2                                | PLBG0176GA-A                                                                                                                                                                                                 |
| H8S/2128                                    | HD64F2128FA20V      | 128            | Y                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | -                    | 2               | -   | -            | 2                   | Y                                                | -                 | 4                           | 51 (24)          | Y            | Y                                     | TMC                                      | PRQP0064GB-A<br>PRDP0064BB-A<br>PTQP0080KC-A<br>PRQP0064GB-A                                                                                                                                                 |
|                                             | HD64F2128PS20V      | 128            | Y                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | -                    | 2               | -   | -            | 2                   | Y                                                | -                 | 4                           | 51 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2128TF20V      | 128            | Y                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | -                    | 2               | -   | -            | 2                   | Y                                                | -                 | 4                           | 51 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2128VFA10V     | 128            | Y                         | 4            | 3.0     | 5.5     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | -                    | 2               | -   | -            | 2                   | Y                                                | -                 | 4                           | 51 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2132<br>and<br>H8S/2134<br>(See Note 6) | HD64F2132RFA20V     | 64             | Y                         | 2            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 15                          | 66 (24)          | Y            | Y                                     |                                          | PRQP0080JB-A<br>PTQP0080KC-A<br>PRQP0080JB-A<br>PTQP0080KC-A                                                                                                                                                 |
|                                             | HD64F2132RTF20V     | 64             | Y                         | 2            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 15                          | 66 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2132RVFA10V    | 64             | Y                         | 2            | 3.0     | 5.5     | 10                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 15                          | 66 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2132RVTF10V    | 64             | Y                         | 2            | 3.0     | 5.5     | 10                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 15                          | 66 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2138A                                   | HD64F2138AFA20V     | 128            | Y                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 15                          | 66 (24)          | Y            | Y                                     | X-Bus, KBD, TMC                          | PRQP0080JB-A<br>PTQP0080KC-A<br>PRQP0080JB-A<br>PTQP0080KC-A                                                                                                                                                 |
|                                             | HD64F2138ATF20V     | 128            | Y                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 15                          | 66 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2138AVFA10V    | 128            | Y                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 15                          | 66 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2138AVTF10V    | 128            | Y                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 15                          | 66 (24)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2140B <sup>5</sup>                      | HD64F2140BVFA10V    | 64             | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     | LPC, X-Bus, KBD,<br>3-ch PS2, TMC, 5v IO | PRQP0100KA-A<br>PTQP0100KA-A<br>PRQP0100KA-A<br>PTQP0100KA-A<br>PTQP0100KA-A<br>PRQP0100KA-A<br>PTQP0100KA-A<br>PTQP0100KA-A<br>PTQP0100KA-A<br>PRQP0100KA-A<br>PTQP0100KA-A<br>PTQP0144LC-A<br>PTQP0144LC-A |
|                                             | HD64F2140BVTE10V    | 64             | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2141BVFA10V    | 128            | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2141BVTE10V    | 128            | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2145BTE20V     | 256            | -                         | 8            | 4.5     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2145BVFA10V    | 256            | -                         | 8            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2145BVTE10V    | 256            | -                         | 8            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2148BVFA20V    | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (34)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2148BFA20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (34)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2148BTE20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (34)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2148BVFA10V    | 128            | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2148BVTE10V    | 128            | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 82 (6)           | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2160BVTE10V    | 64             | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 122 (6)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2161BVTE10V    | 128            | -                         | 4            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 31                          | 122 (6)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2144B                                   | HD64F2134BFA20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 23                          | 66 (24)          | Y            | Y                                     |                                          | PRQP0080JB-A<br>PTQP0080KC-A<br>PRQP0100KA-A<br>PTQP0100KA-A                                                                                                                                                 |
|                                             | HD64F2134BTE20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 23                          | 66 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2144BFA20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 23                          | 82 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2144BTE20V     | 128            | -                         | 4            | 4.0     | 5.5     | 20                | in                            | 3            | 1             | 2               | -         | 2              | 8                     | 2                    | 3               | Y   | -            | -                   | -                                                | -                 | 23                          | 82 (24)          | Y            | Y                                     |                                          |                                                                                                                                                                                                              |
| H8S/2168                                    | HD64F2166VTE33V     | 512            | -                         | 40           | 3.0     | 3.6     | 33                | in                            | 4            | 1             | 2               | 16        | 4              | 8                     | 2                    | 3               | Y   | Y            | 6                   | Y                                                | -                 | 41                          | 115 (0)          | Y            | -                                     | LPC, CRC, HSS,<br>BSCAN, 5v IO, OCD      | PTQP0144LC-A<br>PTQP0144LC-A<br>PTQP0144LC-A                                                                                                                                                                 |
|                                             | HD64F2167VTE33V     | 384            | -                         | 40           | 3.0     | 3.6     | 33                | in                            | 4            | 1             | 2               | 16        | 4              | 8                     | 2                    | 3               | Y   | Y            | 6                   | Y                                                | -                 | 41                          | 115 (0)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
|                                             | HD64F2168VTE33V     | 256            | -                         | 40           | 3.0     | 3.6     | 33                | in                            | 4            | 1             | 2               | 16        | 4              | 8                     | 2                    | 3               | Y   | Y            | 6                   | Y                                                | -                 | 41                          | 115 (0)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2169                                    | HD64F2149YVTE10V    | 64             | -                         | 2            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 9                           | 82 (6)           | Y            | -                                     | LPC, X-Bus, KBD,<br>3-ch PS2, TMC        | PTQP0100KA-A<br>PTQP0144LC-A                                                                                                                                                                                 |
|                                             | HD64F2169YVTE10V    | 64             | -                         | 2            | 2.7     | 3.6     | 10                | in                            | 4            | 1             | 2               | 16        | 2              | 8                     | 2                    | 3               | Y   | -            | 2                   | Y                                                | -                 | 9                           | 122 (6)          | Y            | -                                     |                                          |                                                                                                                                                                                                              |
| H8S/2172                                    | HD64F2170VTE33V     | 256            | -                         | 32           | 3.0     | 3.6     | 33                | -                             | 2            | -             | 1               | -         | -              | -                     | -                    | 1               | -   | -            | -                   | -                                                | 4                 | 9                           | 76 (0)           | Y            | -                                     | USBH, DRAMC                              | PTQP0100KA-A                                                                                                                                                                                                 |
| H8S/2189R                                   | R4F2189VTE20V       | 1024           | -                         | 6            | 3.0     | 3.6     | 20                | in                            | 4            | 4             | 2               | 8         | 2              | 8                     | -                    | 2               | Y   | Y            | 2                   | -                                                | -                 | 49                          | 119 (15)         | -            | -                                     | IP protect, 5v IO                        | PTQP0144LC-A                                                                                                                                                                                                 |

## Notes:

1. "in" = external 32KHz clock input for sub clock mode.
2. This is the sum of the I/O pins + input-only + output-only.
3. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
4. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
5. This group contains a specific voltage supply for some of the GPIO pins. Please refer to the Hardware Manual for full specifications of these pins and voltages.
6. For H8S/2134 devices, please refer to the H8S/2144B Group Hardware Manual.

## H8S/2200 Series Line-up



## ■ Features

- Up to 24MHz, low-power, 16-bit static CPU
- 8 power-down modes for reducing power consumption
- 32kHz sub-clock oscillator circuit allows CPU to be switched to sub-active mode to save power
- Built-in Data Transfer Controller (DTC) with maximum of 85 channels
- Built-in DMA controller (DMAC) with maximum of 4 channels
- Bus-powered/self-powered on-chip USB (v2.0 full speed) core for easy serial connectivity
- 40-segment on-chip LCD controller with voltage booster circuit
- Supports Smart Card interface conforming to ISO/IEC 7816-3
- Multi-channel Inter IC (I<sup>2</sup>C™) two-wire serial bus interface
- Built-in Bus Controller (BSC) provides glueless basic bus or burst-ROM I/F
- Miniature BGA packages smaller than 10mm (per side) with thickness equal to 1.2mm

## ■ Applications

**Computing:** Keyboard controllers, USB slaves, serial-mode converters, power-monitors

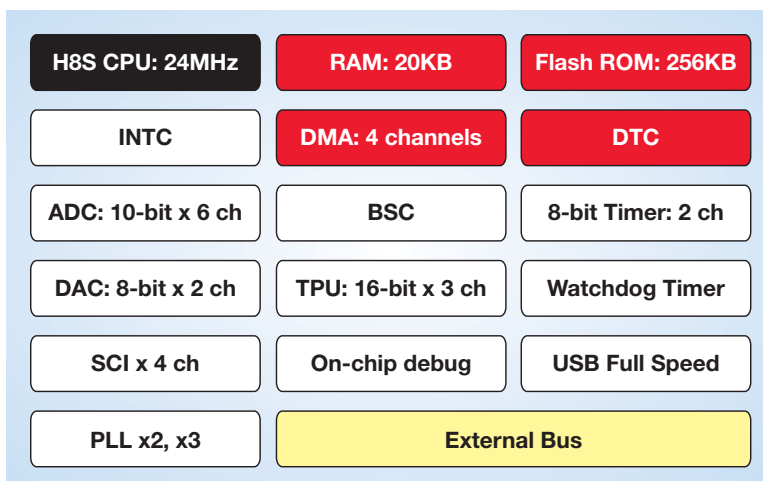
**Metering:** Electric meters, gas meters, water meters, thermostats

**Medical:** Glucose monitors, drug-pump monitors, heart-rate monitors, ambulatory IV pumps

**Industrial/Commercial:** Emissions test equipment, automotive diagnostic instruments, data loggers, barcode scanner

**Network/Communication:** Communication protocol converters, GPS systems

## H8S/2215R Series Block Diagram



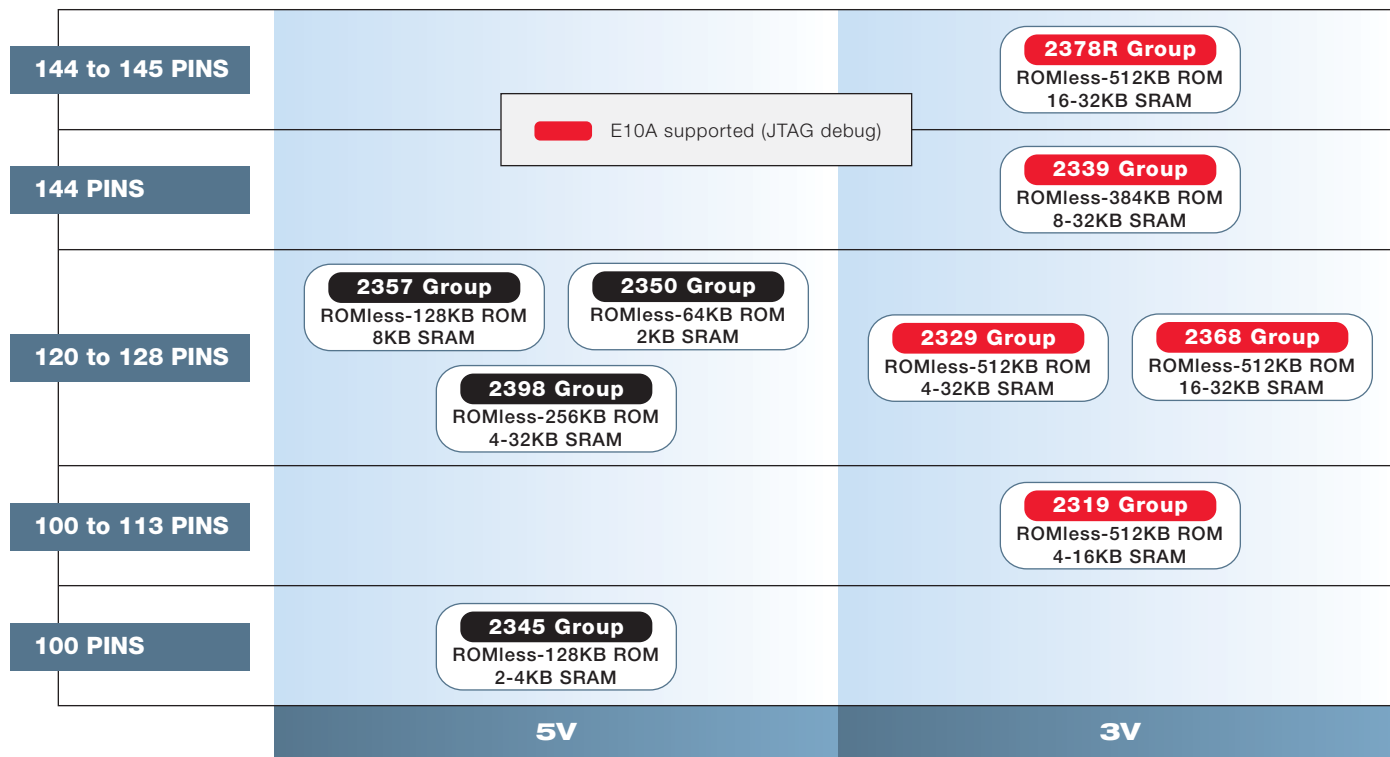
## H8S/2200 Series Selector Guide

| Group     | Catalog Part Number | Flash (Kbytes) | Mask ROM Options (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | 32 kHz Sub Clock (See Note 1) | Timers       |               |                 | Analog                |                      | Serial              |                      | DTC | DMA Channels | External Interrupts | GPIO (See Note 2)<br>(High current) (See Note 3) | External Data Bus | Extended Temp. (See Note 4) | Special Features | Package Code                        |              |
|-----------|---------------------|----------------|---------------------------|--------------|---------|---------|-------------------|-------------------------------|--------------|---------------|-----------------|-----------------------|----------------------|---------------------|----------------------|-----|--------------|---------------------|--------------------------------------------------|-------------------|-----------------------------|------------------|-------------------------------------|--------------|
|           |                     |                |                           |              |         |         |                   |                               | 8-bit Timers | 16-bit Timers | Watchdog Timers | A/D 10-bit Resolution | D/A 8-bit Resolution | Serial (Sync/Async) | Smart Card Interface |     |              |                     |                                                  |                   |                             |                  |                                     | °C           |
| H8S/2212  | HD64F2211FP24V      | 64             | Y                         | 8            | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 37 (0)            | -                           | Y                | USB, RTC, HSS                       | PLQP0064KC-A |
|           | HD64F2211UFP24V     | 64             | Y                         | 8            | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 37 (0)            | -                           | Y                | USB, Boot from USB, RTC, HSS        | PLQP0064KC-A |
|           | HD64F2212FP24V      | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 37 (0)            | -                           | Y                | USB, RTC, HSS                       | PLQP0064KC-A |
|           | HD64F2212UFP24V     | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 37 (0)            | -                           | Y                | USB, Boot from USB, RTC, HSS        | PLQP0064KC-A |
| H8S/2214  | HD64F2214BQ16V      | 128            | Y                         | 12           | 2.7     | 3.6     | 16                | -                             | -            | 3             | 1               | -                     | 1                    | 3                   | -                    | -   | Y            | 4                   | 9                                                | 81 (0)            | Y                           | Y                | HSS                                 | TTBG0112GA-A |
|           | HD64F2214TE16V      | 128            | Y                         | 12           | 2.7     | 3.6     | 16                | -                             | -            | 3             | 1               | -                     | 1                    | 3                   | -                    | -   | Y            | 4                   | 9                                                | 81 (0)            | Y                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2214TF16V      | 128            | Y                         | 12           | 2.7     | 3.6     | 16                | -                             | -            | 3             | 1               | -                     | 1                    | 3                   | -                    | -   | Y            | 4                   | 9                                                | 81 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
| H8S/2215  | HD64F2215BR16V      | 256            | Y                         | 16           | 2.7     | 3.6     | 16                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                | USB, BSCAN, HSS                     | PLBG0112GA-A |
|           | HD64F2215TE16V      | 256            | Y                         | 16           | 2.7     | 3.6     | 16                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                |                                     | PTQP0120LA-A |
|           | HD64F2215UBR16V     | 256            | Y                         | 16           | 2.7     | 3.6     | 16                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                | USB, Boot from USB, BSCAN, HSS      | PLBG0112GA-A |
|           | HD64F2215UTE16V     | 256            | Y                         | 16           | 2.7     | 3.6     | 16                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                |                                     | PTQP0120LA-A |
| H8S/2215R | HD64F2215RBR24V     | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                | USB, BSCAN, HSS, OCD                | PLBG0112GA-A |
|           | HD64F2215RTE24V     | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                |                                     | PTQP0120LA-A |
|           | HD64F2215RUBR24V    | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                | USB, Boot from USB, BSCAN, HSS, OCD | PLBG0112GA-A |
|           | HD64F2215RUTE24V    | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                |                                     | PTQP0120LA-A |
|           | HD64F2215TBR24V     | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                | USB, BSCAN, HSS, OCD                | PLBG0112GA-A |
|           | HD64F2215TTE24V     | 256            | -                         | 20           | 2.7     | 3.6     | 24                | -                             | 2            | 3             | 1               | 6                     | 2                    | 3                   | Y                    | -   | Y            | 4                   | 8                                                | 75 (0)            | Y                           | Y                |                                     | PTQP0120LA-A |
| H8S/2218  | HD64F2218BR24V      | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 69 (0)            | Y                           | Y                | USB, BSCAN, RTC, HSS                | PLBG0112GA-A |
|           | HD64F2218TF24V      | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 69 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
|           | HD64F2218UBR24V     | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 69 (0)            | Y                           | Y                | USB, Boot from USB, BSCAN, RTC, HSS | PLBG0112GA-A |
|           | HD64F2218UTF24V     | 128            | Y                         | 12           | 2.7     | 3.6     | 24                | Y                             | -            | 3             | 1               | 6                     | -                    | 2                   | Y                    | -   | -            | 4                   | 7                                                | 69 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
| H8S/2238B | HD64F2238BR13V      | 256            | Y                         | 16           | 2.7     | 5.5     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                | PC Break                            | PRQP0100JE-B |
|           | HD64F2238BFA13V     | 256            | Y                         | 16           | 2.7     | 5.5     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2238BTE13V     | 256            | Y                         | 16           | 2.7     | 5.5     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2238BTF13V     | 256            | Y                         | 16           | 2.7     | 5.5     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
| H8S/2238R | HD64F2238RBQ13V     | 256            | -                         | 16           | 2.7     | 3.6     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                | PC Break                            | TTBG0112GA-A |
|           | HD64F2238RBQ6V      | 256            | -                         | 16           | 2.2     | 3.6     | 6.25              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | -                |                                     | TTBG0112GA-A |
|           | HD64F2238RBR13V     | 256            | -                         | 16           | 2.7     | 3.6     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PLBG0112GA-A |
|           | HD64F2238RFA13V     | 256            | Y                         | 16           | 2.7     | 3.6     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2238RFA6V      | 256            | Y                         | 16           | 2.2     | 3.6     | 6.25              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PRQP0100KA-A |
|           | HD64F2238RTE13V     | 256            | Y                         | 16           | 2.7     | 3.6     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2238RTE6V      | 256            | Y                         | 16           | 2.2     | 3.6     | 6.25              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PTQP0100KA-A |
|           | HD64F2238RTF13V     | 256            | Y                         | 16           | 2.7     | 3.6     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
|           | HD64F2238RTF6V      | 256            | Y                         | 16           | 2.2     | 3.6     | 6.25              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PTQP0100LC-A |
| H8S/2239  | HD64F2239BQ16V      | 384            | -                         | 32           | 2.7     | 3.6     | 16                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | -                | PC Break, HSS                       | TTBG0112GA-A |
|           | HD64F2239BQ20V      | 384            | -                         | 32           | 3.0     | 3.6     | 20                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | TTBG0112GA-A |
|           | HD64F2239FA16V      | 384            | Y                         | 32           | 2.7     | 3.6     | 16                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PRQP0100KA-A |
|           | HD64F2239FA20V      | 384            | Y                         | 32           | 3.0     | 3.6     | 20                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2239TE16V      | 384            | Y                         | 32           | 2.7     | 3.6     | 16                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PTQP0100KA-A |
|           | HD64F2239TE20V      | 384            | Y                         | 32           | 3.0     | 3.6     | 20                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2239TF16V      | 384            | Y                         | 32           | 2.7     | 3.6     | 16                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | -                |                                     | PTQP0100LC-A |
|           | HD64F2239TF20V      | 384            | Y                         | 32           | 3.0     | 3.6     | 20                | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | 4                   | 9                                                | 82 (0)            | Y                           | Y                |                                     | PTQP0100LC-A |
| H8S/2258  | HD64F2258FA13V      | 256            | Y                         | 16           | 4.0     | 5.5     | 13.5              | Y                             | 4            | 6             | 2               | 8                     | 2                    | 4                   | Y                    | 2   | Y            | -                   | 9                                                | 82 (0)            | Y                           | Y                | PC Break, IEB                       | PRQP0100KA-A |
| H8S/2268  | HD64F2265FA13V      | 128            | Y                         | 4            | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                | PC Break, 40x4 LCDC, DTMF, HSS      | PRQP0100KA-A |
|           | HD64F2265FA20V      | 128            | Y                         | 4            | 4.0     | 5.5     | 20.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2265TE13V      | 128            | Y                         | 4            | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2266FA13V      | 128            | Y                         | 8            | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2266TF13V      | 128            | Y                         | 8            | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PTQP0100LC-A |
|           | HD64F2266TF20V      | 128            | Y                         | 8            | 4.0     | 5.5     | 20.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PTQP0100LC-A |
|           | HD64F2268FA13V      | 256            | Y                         | 16           | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2268FA20V      | 256            | Y                         | 16           | 4.0     | 5.5     | 20.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PRQP0100KA-A |
|           | HD64F2268TE13V      | 256            | Y                         | 16           | 3.0     | 5.5     | 13.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PTQP0100KA-A |
|           | HD64F2268TE20V      | 256            | Y                         | 16           | 4.0     | 5.5     | 20.5              | Y                             | 4            | 3             | 1               | 10                    | 2                    | 3                   | Y                    | 2   | Y            | -                   | 14                                               | 78 (8)            | -                           | Y                |                                     | PTQP0100KA-A |
| H8S/2282  | HD64F2282F20V       | 128            | Y                         | 4            | 4.5     | 5.5     | 20                | DIV                           | -            | 3             | 2               | 8                     | -                    | 2                   | Y                    | -   | -            | -                   | 7                                                | 72 (0)            | -                           | Y                | 28x4 LCDC, PWM timer, CAN           | PRQP0100JE-B |

## Notes:

- KEY: Y = Yes, includes 32kHz crystal oscillator circuitry; "DIV" = Main clock is divided down for sub clock mode.
- This is the sum of the I/O pins + input-only + output-only.
- High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
- Please visit Renesas website for full part number, specification, and availability of extended temperature parts.

## H8S/2300 Series Line-up



## ■ Features

- Up to 35MHz, low-power, 16-bit static CPU
- 6 power-down modes for reducing power consumption
- Built-in Data Transfer Controller (DTC) with max. 85 channels
- Built-in DMA controller (DMAC) with maximum of 4 channels
- IrDA Interface for easy wireless connectivity
- Supports Smart Card interface conforming to ISO/IEC 7816-3
- 16-bit PPG with up to four different 4-bit group outputs
- Built-in Bus Controller (BSC) with arbitration bus to manage basic bus or burst-ROM interface
- Miniature BGA packages smaller than 10mm (per side) with thickness equal to 1.2mm

## ■ Applications

**Computing:** Printers, label printers, touch screen controllers, CD R/W drives

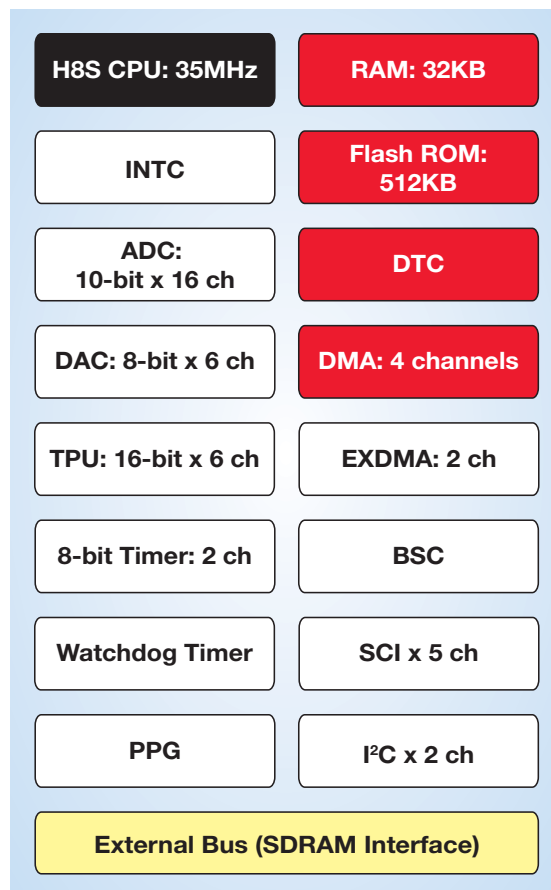
**Industrial:** Data analyzers, emission test equipment, GPS systems, Barcode scanners

**Automotive:** Car audio, automotive diagnostic equipment

**Medical:** Blood oxygen monitors, drug pump monitors, heart rate monitors

**Network/Communication:** LAN hubs, GPS systems

## H8S/2378R Series Block Diagram



## H8S/2300 Series Selector Guide — Part 1 of 2

| Group    | Catalog Part Number | Flash (Kbytes) | Mask ROM Options (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | 8-bit Timers | 16-bit Timers | Watchdog Timers | Waveform Generator (PPG) | A/D 10-bit Resolution | D/A 8-bit Resolution | Serial (Sync/Async) | IrDA | Smart Card Interface | PC | DTC | DMA Channels | External Interrupts | GPIO [See Note 1]<br>(High Current) [See Note 2] | External Data Bus | Extended Temperature (See Note 3) | Special Features | Package Code |
|----------|---------------------|----------------|---------------------------|--------------|---------|---------|-------------------|--------------|---------------|-----------------|--------------------------|-----------------------|----------------------|---------------------|------|----------------------|----|-----|--------------|---------------------|--------------------------------------------------|-------------------|-----------------------------------|------------------|--------------|
| H8S/2319 | HD6412312SVF20V     | -              | -                         | 8            | 3.0     | 3.6     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD6412312SVF25V     | -              | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD6412312SVTE20V    | -              | -                         | 8            | 3.0     | 3.6     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD6412312SVTE25V    | -              | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2314VTE25V     | 384            | Y                         | 4            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2315VF25V      | 384            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD64F2315VTE25V     | 384            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2317VTE25V     | 128            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2317VTF25V     | 128            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100LC-A |
|          | HD64F2318VF25V      | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD64F2318VTE25V     | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2318VTF25V     | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100LC-A |
|          | HD64F2319CVF25V     | 512            | -                         | 16           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD64F2319CVLP25V    | 512            | -                         | 16           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTL0113JA-A  |
|          | HD64F2319CVTE25V    | 512            | -                         | 16           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2319EVF25V     | 512            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD64F2319EVTE25V    | 512            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
|          | HD64F2319VF25V      | 512            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PRQP0100JE-B |
|          | HD64F2319VTE25V     | 512            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (0)                                           | Y                 | -                                 |                  | PTQP0100KA-A |
| H8S/2329 | HD6412320VF20V      | -              | -                         | 4            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 | DRAMC            | PRQP0128KB-A |
|          | HD6412320VF25V      | -              | -                         | 4            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412320VTE20V     | -              | -                         | 4            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412320VTE25V     | -              | -                         | 4            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412321VF20V      | -              | -                         | 4            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | -            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412321VF25V      | -              | -                         | 4            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | -            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412321VTE20V     | -              | -                         | 4            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | -            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412321VTE25V     | -              | -                         | 4            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | -            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412322RVF20V     | -              | -                         | 8            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412322RVF25V     | -              | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412322RVTE20V    | -              | -                         | 8            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412322RVTE25V    | -              | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412324SVF25V     | -              | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD6412324SVTE20V    | -              | -                         | 32           | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412324SVTE25V    | -              | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD64F2326CVF25V     | 512            | -                         | 16           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD64F2326CVTE25V    | 512            | -                         | 16           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD64F2326VF25V      | 512            | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD64F2326VTE25V     | 512            | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD64F2328BVF25V     | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD64F2328BVFTE25V   | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
| H8S/2339 | HD64F2329BVF25V     | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD64F2329BVTE25V    | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD64F2329EVF25V     | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A |
|          | HD64F2329EVTE25V    | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A |
|          | HD6412332VFC20V     | -              | -                         | 8            | 2.7     | 3.6     | 20                | 2            | 6             | 1               | 16                       | 12                    | 4                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 118 (0)                                          | Y                 | -                                 |                  | PRQP0144KA-A |
| H8S/2339 | HD6412332VFC25V     | -              | -                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 12                    | 4                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 118 (0)                                          | Y                 | -                                 |                  | PRQP0144KA-A |
|          | HD64F2338VFC25V     | 256            | Y                         | 8            | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 12                    | 4                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 118 (0)                                          | Y                 | -                                 |                  | PRQP0144KA-A |
|          | HD64F2339EVFC25V    | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 12                    | 4                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 118 (0)                                          | Y                 | -                                 |                  | PRQP0144KA-A |
|          | HD64F2339VFC25V     | 384            | -                         | 32           | 3.0     | 3.6     | 25                | 2            | 6             | 1               | 16                       | 12                    | 4                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 118 (0)                                          | Y                 | -                                 |                  | PRQP0144KA-A |

(The H8S/2300 Series Selector Guide is continued on page 31)

## Notes:

1. This is the sum of the I/O pins + input-only + output-only.
2. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
3. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.

When it comes to USB,  
**H8 stands in front.**

# simplicity + greater design versatility

## *H8 Microcontrollers Can Be Self-Powered or USB Bus-Powered*

With Renesas H8 devices, there's no need to create two designs to satisfy different power requirements for applications that use USB links. Selection of self-powered or USB-bus powered operation is made via an input pin. Either way, when the USB cable is disconnected from your system, the microcontroller is automatically put into a defined state, a powered-down mode. A simple, effective solution. Apply it and see for yourself!



### Guide to USB-compatible H8S Devices

| Group                                                                                 | ROM/RAM/Speed    | Features                                                                                                            |
|---------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>USB 2.0 Full-Speed [Bulk, Interrupt, Control transfers supported]</b>              |                  |                                                                                                                     |
| H8S/2212                                                                              | 128KB/12KB/24MHz | Single Chip, Sub Clock, On-Chip Debugger                                                                            |
| H8S/2211                                                                              | 64KB/8KB/24MHz   | <b>USB FIFO:</b> 456 Bytes <b>Package:</b> 64-pin QFP                                                               |
| H8S/2218                                                                              | 128KB/12KB/24MHz | Sub Clock, On-Chip Debugger                                                                                         |
| H8SX/1664                                                                             | 512KB/40KB/48MHz | On-Chip Debugger                                                                                                    |
| H8SX/1663                                                                             | 384KB/40KB/48MHz | <b>USB FIFO:</b> 288 Bytes <b>Package:</b> 144-pin LQFP                                                             |
| H8SX/1654                                                                             | 512KB/40KB/48MHz | On-Chip Debugger                                                                                                    |
| H8SX/1653                                                                             | 384KB/40KB/48MHz | <b>USB FIFO:</b> 288 Bytes <b>Package:</b> 120-pin QFP                                                              |
| <b>USB 2.0 Full-Speed [Isochronous, Bulk, Interrupt, Control transfers supported]</b> |                  |                                                                                                                     |
| H8S/2215                                                                              | 256KB/16KB/16MHz | <b>USB FIFO:</b> 1288 Bytes<br><b>Packages:</b> 120-pin QFP, 112-pin BGA                                            |
| H8S/2215R                                                                             | 256KB/20KB/24MHz | On-Chip Debugger, USB Cera Lock Support<br><b>USB FIFO:</b> 1288 Bytes<br><b>Packages:</b> 120-pin QFP, 112-pin BGA |
| <b>USB 2.0 High-Speed/Full-Speed [Bulk, Interrupt, Control transfers supported]</b>   |                  |                                                                                                                     |
| H8S/2170B                                                                             | 256KB/32KB/33MHz | On-Chip Debugger<br><b>USB FIFO:</b> 1224 Bytes <b>Package:</b> 100-pin QFP                                         |

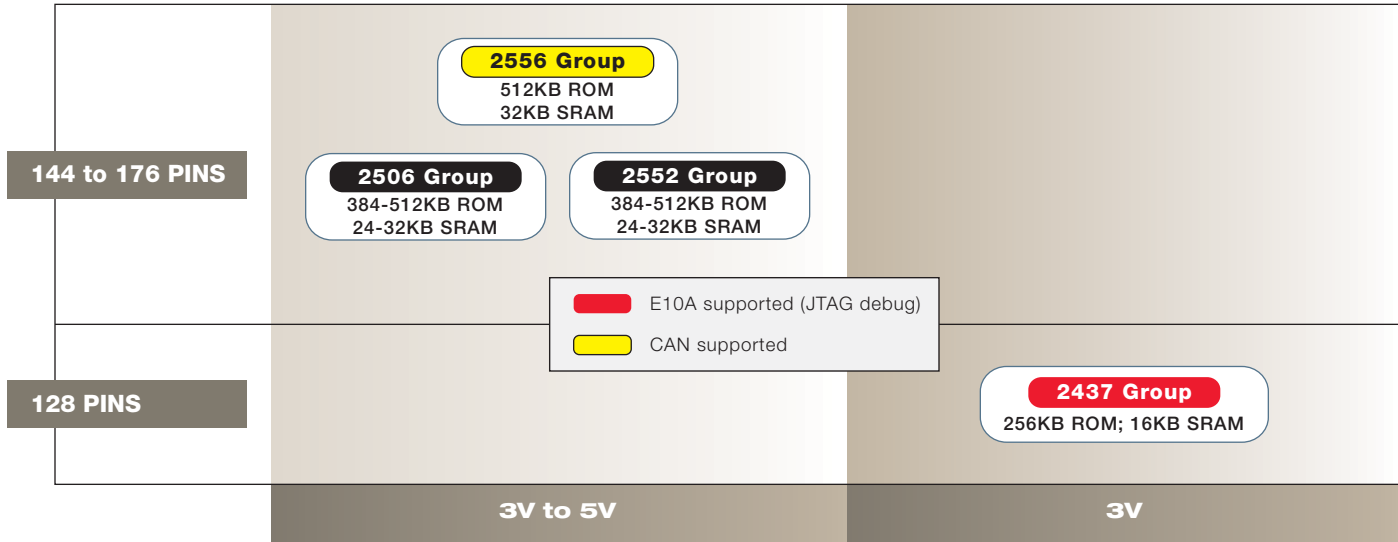
## H8S/2300 Series Selector Guide — Part 2 of 2

| Group            | Catalog Part Number           | Flash (Kbytes) | Mask ROM Options (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | 8-bit Timers | 16-bit Timers | Watchdog Timers | Waveform Generator (PPG) | A/D 10-bit Resolution | D/A 8-bit Resolution | Serial (Sync/Async) | IrDA | Smart Card Interface | fC | DTC | DMA Channels | External Interrupts | GPIO [See Note 1]<br>(High Current) [See Note 2] | External Data Bus | Extended Temperature (See Note 3) | Special Features | Package Code                    |              |
|------------------|-------------------------------|----------------|---------------------------|--------------|---------|---------|-------------------|--------------|---------------|-----------------|--------------------------|-----------------------|----------------------|---------------------|------|----------------------|----|-----|--------------|---------------------|--------------------------------------------------|-------------------|-----------------------------------|------------------|---------------------------------|--------------|
| H8S/2345         | HD6412340FA10V                | -              | -                         | 2            | 2.7     | 5.5     | 10                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PRQP0100KA-A                    |              |
|                  | HD6412340FA20V                | -              | -                         | 2            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PRQP0100KA-A                    |              |
|                  | HD6412340TE20V                | -              | -                         | 2            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PTQP0100KA-A                    |              |
|                  | HD64F2345F20V                 | 128            | Y                         | 4            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PRQP0100JE-B                    |              |
|                  | HD64F2345FA20V                | 128            | Y                         | 4            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PRQP0100KA-A                    |              |
|                  | HD64F2345TE20V                | 128            | Y                         | 4            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | -                        | 8                     | 2                    | 2                   | -    | Y                    | -  | Y   | -            | 9                   | 79 (28)                                          | Y                 | Y                                 |                  | PTQP0100KA-A                    |              |
| H8S/2357         | HD6412352F13V                 | -              | -                         | 8            | 3.0     | 5.5     | 13                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412352F20V                 | -              | -                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412352TE13V                | -              | -                         | 8            | 3.0     | 5.5     | 13                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD6412352TE20V                | -              | -                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD64F2357F20V                 | 128            | Y                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD64F2357TE20V                | 128            | Y                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD64F2357VF13V                | 128            | Y                         | 8            | 3.0     | 5.5     | 13                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD64F2357VTE13V               | 128            | Y                         | 8            | 3.0     | 5.5     | 13                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
| H8S/2368         | HD64F2360VTE33V <sup>4</sup>  | 256            | Y                         | 16           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | TPTQ0120LA-A                    |              |
|                  | HD64F2361VTE33V <sup>4</sup>  | 256            | -                         | 24           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | TPTQ0120LA-A                    |              |
|                  | HD64F2362VTE33V               | 256            | -                         | 32           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | TPTQ0120LA-A                    |              |
|                  | HD6412363VF33V                | -              | -                         | 16           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412363VTE33V               | -              | -                         | 16           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD64F2364VTE33V <sup>4</sup>  | 384            | -                         | 32           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | TPTQ0120LA-A                    |              |
|                  | HD64F2366VF33V                | 384            | -                         | 30           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | -                        | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | -            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD64F2366VTE33V               | 384            | -                         | 30           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | -                        | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | -            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD64F2367VF33V                | 384            | -                         | 24           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD64F2367VTE33V               | 384            | -                         | 24           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
| H8S/2378R        | HD64F2368VTE34V               | 512            | -                         | 32           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 10                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 9                   | 94 (0)                                           | Y                 | -                                 |                  | DRAMC, HSS                      | PTQP0120LA-A |
|                  | HD6412370VFQ34V <sup>4</sup>  | 256            | Y                         | 16           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412370RVFQ34V <sup>4</sup> | 256            | Y                         | 16           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412371VFQ34V <sup>4</sup>  | 256            | -                         | 24           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412371RVFQ34V <sup>4</sup> | 256            | -                         | 24           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412372VFQ34V <sup>4</sup>  | 256            | -                         | 32           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412372RVFQ34V <sup>4</sup> | 256            | -                         | 32           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD6412373RVFQ33V              | -              | -                         | 16           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 16                    | 2                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | SDRAMC, HSS                     | PLQP0144KC-A |
|                  | HD6412374VFQ34V <sup>4</sup>  | 384            | -                         | 32           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | DRAMC, HSS                      | PLQP0144KC-A |
|                  | HD6412374RVFQ34V <sup>4</sup> | 384            | -                         | 32           | 3.0     | 3.6     | 34                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 4            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD64F2376VFQ33V               | 384            | -                         | 30           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 16                    | 4                    | 5                   | Y    | Y                    | 2  | Y   | 6            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | HSS                             | PLQP0144KC-A |
|                  | HD64F2377RVFQ33V              | 384            | -                         | 24           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 6            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | SDRAMC, HSS, BT,<br>2 ch EXDMAC | PLQP0144KC-A |
|                  | HD64F2377RVFQ33WV             | 384            | -                         | 24           | 3.0     | 3.6     | 33                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 6            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | PLQP0144KC-A                    |              |
|                  | HD64F2378BVL35V               | 512            | -                         | 32           | 3.0     | 3.6     | 35                | 2            | 6             | 1               | 16                       | 16                    | 6                    | 5                   | Y    | Y                    | 2  | Y   | 6            | 17                  | 113 (0)                                          | Y                 | -                                 |                  | DRAMC, HSS,<br>2 ch EXDMAC      | PTLG0145JB-A |
| HD64F2378BVFQ35V | 512                           | -              | 32                        | 3.0          | 3.6     | 35      | 2                 | 6            | 1             | 16              | 16                       | 6                     | 5                    | Y                   | Y    | 2                    | Y  | 6   | 17           | 113 (0)             | Y                                                | -                 |                                   | PLQP0144KC-A     |                                 |              |
| H8S/2398         | HD6412390F20V                 | -              | -                         | 4            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412390TE20V                | -              | -                         | 4            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD6412392F20V                 | -              | -                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412392TE20V                | -              | -                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD6412394F20V                 | -              | -                         | 32           | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD6412394TE20V                | -              | -                         | 32           | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |
|                  | HD64F2398F20V                 | 256            | Y                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PRQP0128KB-A                    |              |
|                  | HD64F2398TE20V                | 256            | Y                         | 8            | 4.5     | 5.5     | 20                | 2            | 6             | 1               | 16                       | 8                     | 2                    | 3                   | -    | Y                    | -  | Y   | 4            | 9                   | 95 (32)                                          | Y                 | -                                 |                  | PTQP0120LA-A                    |              |

## Notes:

1. This is the sum of the I/O pins + input-only + output-only.
2. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
3. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
4. The specification for this device is subject to change.

## H8S/2400/2500 Series Line-up



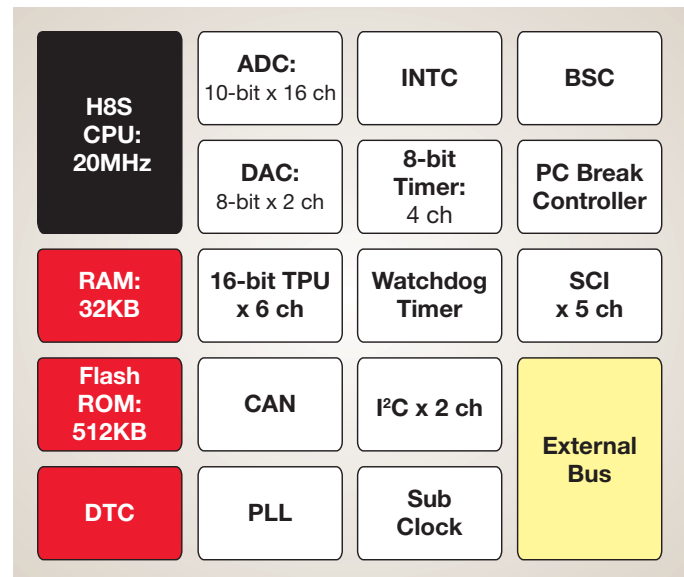
### ■ Features for H8S/2400 Series

- Up to 20MHz, 16 bit CISC CPU with Hardware Multiply Accumulate Block (H8S/2600 CPU)
- 8 power-down modes for reducing power consumption
- 32kHz sub-clock oscillator
- Support Smart Card interface conforming to ISO/IEC 7816-3

### ■ Features for H8S/2500 Series

- Up to 26MHz, 16 bit CISC CPU
- 6 power-down modes for reducing power consumption
- 32kHz sub-clock oscillator
- Built-in Data Transfer Controller (DTC) with maximum of 85 channels
- Up to 2-channel Controller Area Network (CAN v2.0) controller
- Support Smart Card interface conforming to ISO/IEC 7816-3
- Dual 3V and 5V I/O functions supported

### H8S/2556 Block Diagram



### ■ Applications

**H8S/2400 Series:** LCD Monitor, LCD-TV, Plasma-TV, projectors, home electronics

**H8S/2500 Series:** Audio, automotive audio

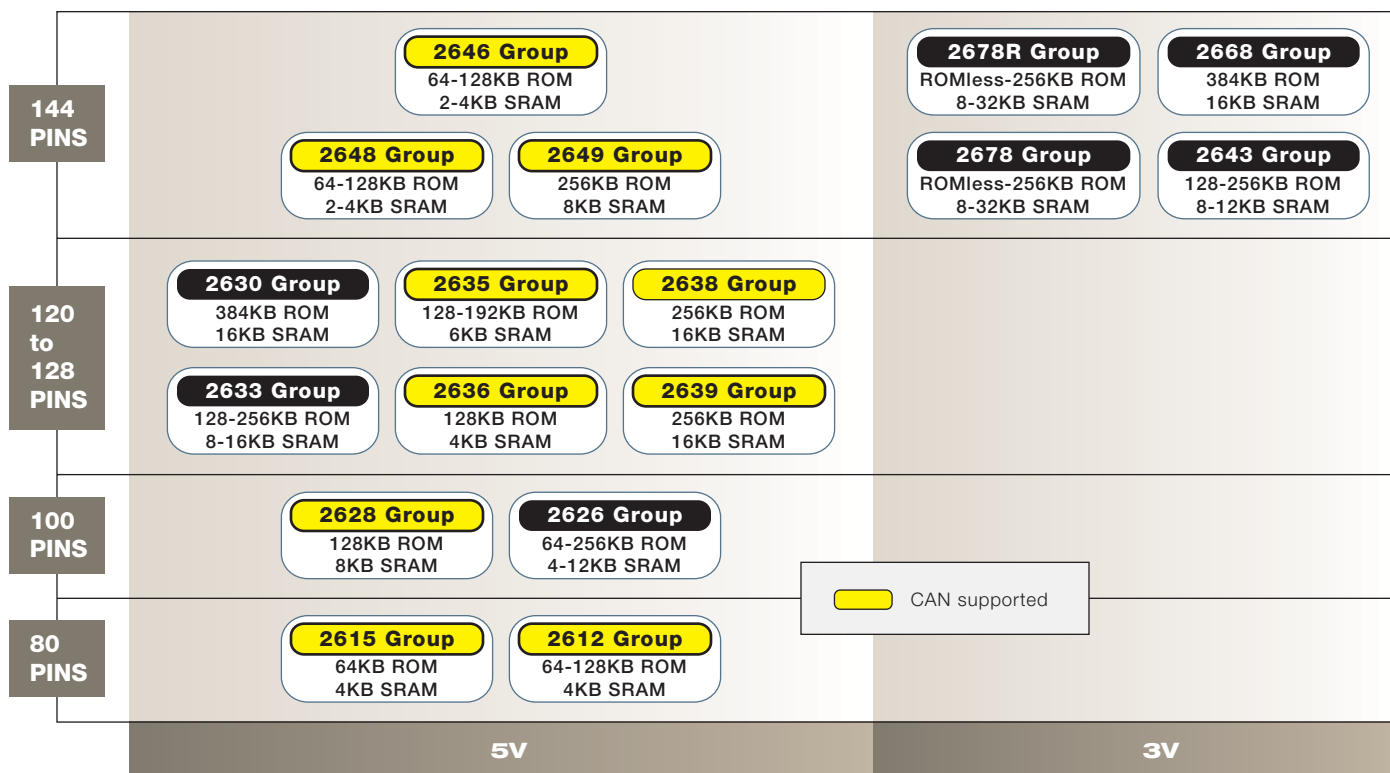
## H8S/2400 and H8S/2500 Series Selector Guide

| Group    | Part Number     | Flash (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max MHz @ Vcc Max | VccIO Min (See Note 4) | VccIO Max (See Note 4) | 32 kHz Sub Clock (See Note 1) | Timers       |               |                 |           |                | Analog                |                      | Serial              |      |                      |                  | DTC | External Interrupts |                   |                   |                             | Special Features           | Package Code |
|----------|-----------------|----------------|--------------|---------|---------|-------------------|------------------------|------------------------|-------------------------------|--------------|---------------|-----------------|-----------|----------------|-----------------------|----------------------|---------------------|------|----------------------|------------------|-----|---------------------|-------------------|-------------------|-----------------------------|----------------------------|--------------|
|          |                 |                |              |         |         |                   |                        |                        |                               | 8-bit Timers | 16-bit Timers | Watchdog Timers | 8-bit PWM | 14-bit PWM D/A | A/D 10-bit Resolution | D/A 8-bit Resolution | Serial (Sync/Async) | IrDA | Smart Card Interface | I <sup>2</sup> C |     | External Interrupts | GPIO (See Note 2) | External Data Bus | Extended Temp. (See Note 3) |                            |              |
| H8S/2437 | HD64F2437FV     | 256            | 16           | 3.0     | 3.6     | 20                | -                      | -                      | -                             | 4            | 5             | 1               | 8         | 2              | 16                    | -                    | 5                   | -    | -                    | 4                | -   | 9                   | 110               | Y                 | -                           | DMC, TMC, 5v IO, Bus Trace | PRQP0128KB-A |
| H8S/2506 | HD64F2505BR26DV | 384            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           | PC Break, Dual Vcc IO      | PLBG0176GA-A |
|          | HD64F2505FC26V  | 384            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PRQP0144KB-A |
|          | HD64F2506BR26DV | 512            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PLBG0176GA-A |
|          | HD64F2506FC26V  | 512            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PRQP0144KB-A |
| H8S/2552 | HD64F2551BR26DV | 384            | 24           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           | PC Break, Dual Vcc IO, IEB | PLBG0176GA-A |
|          | HD64F2551FC26DV | 384            | 24           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PRQP0144KB-A |
|          | HD64F2552BR26DV | 512            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PLBG0176GA-A |
|          | HD64F2552FC26DV | 512            | 32           | 3.0     | 5.5     | 26                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           |                            | PRQP0144KB-A |
| H8S/2556 | HD64F2556FC20DV | 512            | 32           | 3.0     | 5.5     | 20                | 3.0                    | 5.5                    | Y                             | 4            | 6             | 2               | -         | -              | 16                    | 2                    | 5                   | -    | Y                    | 2                | Y   | 9                   | 120               | Y                 | Y                           | PC Break, Dual Vcc IO, CAN | PRQP0144KB-A |

## Notes:

1. Y = Yes, includes 32kHz crystal oscillator circuitry.
2. This is the sum of the I/O pins + input-only + output-only.
3. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
4. This voltage supply is specific to some of the GPIO pins and independent of Vcc.

## H8S/2600 Series Line-up



## ■ Features

- Up to 33MHz, low-power, 16-bit static CPU and hardware MAC
- 6 power-down modes for reducing power consumption
- 32kHz sub-clock oscillator circuit (some devices)
- Built-in Data Transfer Controller (DTC) with maximum of 85 channels
- Built-in DMA controller (DMAC) with maximum of 4 channels
- Up to 2-channel Controller Area Network (CAN v2.0) controller
- Supports Smart Card interface conforming to ISO/IEC 7816-3
- 16-bit motor-control PWM
- 2-channel on-chip PC Break controller for self-monitoring debugger
- Built-in Bus Controller (BSC) with arbitration bus to manage basic bus or burst-ROM interface
- Built-in SDRAM interface (H8S/2674R only)

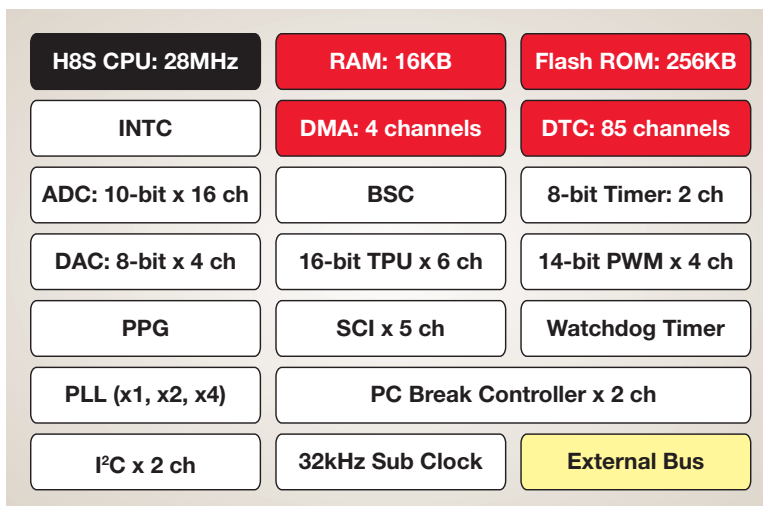
## ■ Applications

**Automotive:** Airbag controllers, radar-collision avoidance systems, body ride/handling control systems, tire pressure monitors, electronic power-steering systems

**Industrial:** Pump controls, test-fixture controllers, pump units, thermal point controllers, siren controllers

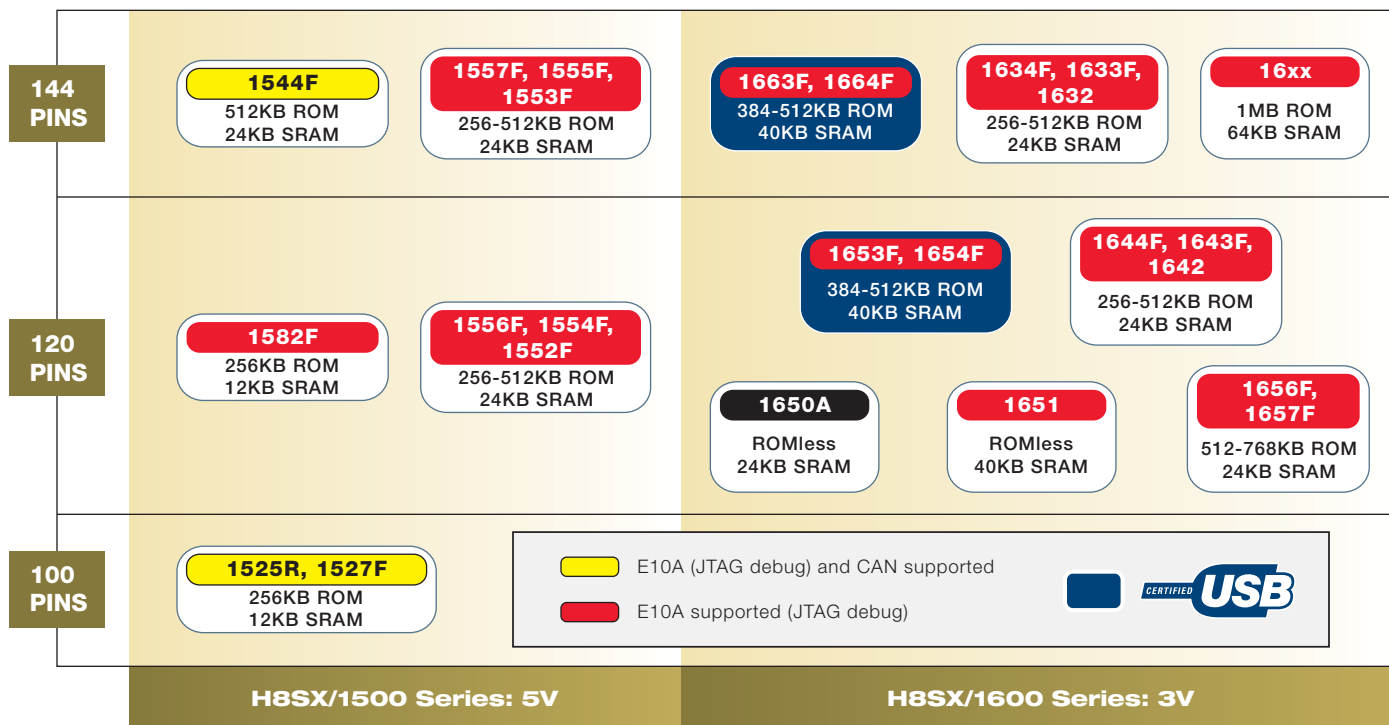
**Medical:** Wireless base stations, fiber controllers for cable TV, network system controllers

## H8S/2633 Series Block Diagram





## H8SX Series Line-up



### ■ Features

- Up to 50MHz, low-power, 32-bit static CISC CPU
- 6 power-down modes for reducing power consumption
- 32kHz sub-clock oscillator circuit (some devices)
- Highly reliable built-in single-supply flash: 256KB to 1MB
- On-chip high-speed SRAM: 12KB to 64KB
- Built-in Data Transfer Controller (DTC) with maximum of 85 channels
- Built-in DMA controller (DMAC) with maximum of 4 channels
- Bus-powered/self-powered on-chip USB (v2.0 full speed) core for easy serial connectivity
- Up to 2-channel Controller Area Network (CAN v2.0) controller
- Supports Smart Card interface conforming to ISO/IEC 7816-3
- Built-in Bus Controller (BSC) with arbitration bus to manage basic bus or burst-ROM interface
- Built-in SDRAM interface (H8SX/1664 only)

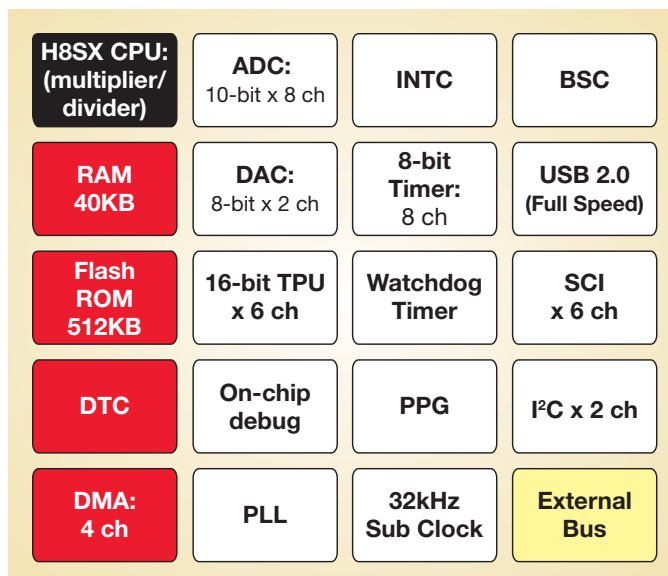
### ■ Applications

**Automotive:** Airbag controllers, power steering systems

**Industrial:** Control Modules (LCD, USB), Bar Code scanners, Electronic Point of Sale

**Consumer:** Fitness Machines, Thermostat, Handheld Devices (Bluetooth), Printers, USB Dongles

### H8SX/1664 Series Block Diagram



## H8SX Series Selector Guide

| Group                  | Part Number     | Flash (Kbytes) | RAM (Kbytes) | Vcc Min | Vcc Max | Max. MHz @ Vcc Max | 32kHz Sub Clock (See Note 1) | Timers       |               |                 |                          | Analog                |                      | Serial              |                      |      |                      |                  |     | DTC | DMA Channels | External Interrupts | GPIO (See Note 2)<br>(High Current) [See Note 3] | External Data Bus | Extended Temp. (See Note 4) | Special Features | Package Code |
|------------------------|-----------------|----------------|--------------|---------|---------|--------------------|------------------------------|--------------|---------------|-----------------|--------------------------|-----------------------|----------------------|---------------------|----------------------|------|----------------------|------------------|-----|-----|--------------|---------------------|--------------------------------------------------|-------------------|-----------------------------|------------------|--------------|
|                        |                 |                |              |         |         |                    |                              | 8-bit Timers | 16-bit Timers | Watchdog Timers | Waveform Generator (PPG) | A/D 10-bit Resolution | D/A 8-bit Resolution | Serial (Sync/Async) | SSU (SPI compatible) | IrDA | Smart Card Interface | I <sup>2</sup> C | CAN |     |              |                     |                                                  |                   |                             |                  |              |
| H8SX/1525              | R5F61525N40FP   | 256            | 12           | 4.5     | 5.5     | 40                 | -                            | -            | 6             | 1               | -                        | 16                    | -                    | 2                   | 3                    | -    | Y                    | -                | 1   | -   | 4            | 16                  | 82 (0)                                           | -                 | Y                           | -                | PRQP0100KB-A |
| H8SX/1527              | R5F61527N40FP   | 256            | 12           | 4.5     | 5.5     | 40                 | -                            | -            | 12            | 1               | 8                        | 16                    | -                    | 2                   | 3                    | -    | Y                    | -                | 1   | -   | 4            | 16                  | 82 (0)                                           | -                 | Y                           | -                | PRQP0100KB-A |
| H8SX/1552 <sup>5</sup> | R5F61552N40FPV  | 256            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1553 <sup>5</sup> | R5F61553N40FPV  | 256            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 6             | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1554 <sup>5</sup> | R5F61554N40FPV  | 384            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1555 <sup>5</sup> | R5F61555N40FPV  | 384            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1556 <sup>5</sup> | R5F61556N40FPV  | 512            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1557 <sup>5</sup> | R5F61557N40FPV  | 512            | 24           | 4.5     | 5.5     | 40                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1582              | R5F61582N48FPV  | 256            | 12           | 4.5     | 5.5     | 48                 | -                            | -            | 12            | 1               | 8                        | 16                    | -                    | 2                   | 3                    | -    | Y                    | -                | -   | Y   | 4            | 17                  | 99 (0)                                           | -                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1632 <sup>5</sup> | R5F61632N50FPV  | 256            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1633 <sup>5</sup> | R5F61633N50FPV  | 384            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1634 <sup>5</sup> | R5F61634N50FPV  | 512            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PRQP0144KB-A |
| H8SX/1642 <sup>5</sup> | R5F61642N50FPV  | 256            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1643 <sup>5</sup> | R5F61643N50FPV  | 384            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1644 <sup>5</sup> | R5F61644N50FPV  | 512            | 24           | 3.0     | 3.6     | 50                 | -                            | 4            | 12            | 1               | -                        | 16                    | 2                    | 6                   | -                    | -    | Y                    | 2                | -   | Y   | 4            | 16                  | 82 (0)                                           | Y                 | Y                           | -                | PLQP0120LA-A |
| H8SX/1650              | R5S61650N35FTV  | 0              | 24           | 3.0     | 3.6     | 35                 | -                            | 4            | 6             | 1               | 16                       | 8                     | 2                    | 4                   | -                    | Y    | Y                    | -                | -   | Y   | -            | 13                  | 90 (8)                                           | Y                 | -                           | HSS              | PTQP0120LA-A |
| H8SX/1651              | R5S61651N50FPV  | 0              | 40           | 3.0     | 3.6     | 35                 | -                            | 4            | 6             | 1               | 16                       | 8                     | 2                    | 4                   | -                    | Y    | Y                    | -                | -   | Y   | -            | 13                  | 90 (8)                                           | Y                 | -                           | HSS              | PLQP0120LA-A |
| H8SX/1653              | R5F61653N50FTV  | 384            | 40           | 3.0     | 3.6     | 50                 | -                            | 4            | 6             | 1               | 8                        | 8                     | 2                    | 6                   | -                    | Y    | Y                    | 2                | -   | Y   | 4            | 13                  | 84 (125)                                         | Y                 | -                           | CRC, HSS, USB    | PTQP0120LA-A |
| H8SX/1654              | R5F61654N50FTV  | 512            | 40           | 3.0     | 3.6     | 50                 | -                            | 4            | 6             | 1               | 8                        | 8                     | 2                    | 6                   | -                    | Y    | Y                    | 2                | -   | Y   | 4            | 13                  | 84 (125)                                         | Y                 | -                           | CRC, HSS, USB    | PTQP0120LA-A |
| H8SX/1657              | R5F61657BN35FTV | 768            | 24           | 3.0     | 3.6     | 35                 | -                            | 4            | 6             | 1               | 16                       | 8                     | 2                    | 4                   | -                    | Y    | Y                    | -                | -   | Y   | 4            | 13                  | 90 (8)                                           | Y                 | -                           | HSS              | PTQP0120LA-A |
|                        | R5F61657N35FTV  | 768            | 24           | 3.0     | 3.6     | 35                 | -                            | 4            | 6             | 1               | 16                       | 8                     | 2                    | 4                   | -                    | Y    | Y                    | -                | -   | Y   | 4            | 13                  | 90 (8)                                           | Y                 | -                           |                  | PTQP0120LA-A |
| H8SX/1663              | R5F61663N50FTV  | 384            | 40           | 3.0     | 3.6     | 50                 | Y                            | 4            | 6             | 1               | 8                        | 8                     | 2                    | 6                   | -                    | Y    | Y                    | 2                | -   | Y   | 4            | 13                  | 101 (125)                                        | Y                 | -                           | CRC, HSS, USB    | PRQP0144KB-A |
| H8SX/1664              | R5F61664N50FTV  | 512            | 40           | 3.0     | 3.6     | 50                 | Y                            | 4            | 6             | 1               | 8                        | 8                     | 2                    | 6                   | -                    | Y    | Y                    | 2                | -   | Y   | 4            | 13                  | 101 (125)                                        | Y                 | -                           | CRC, HSS, USB    | PRQP0144KB-A |

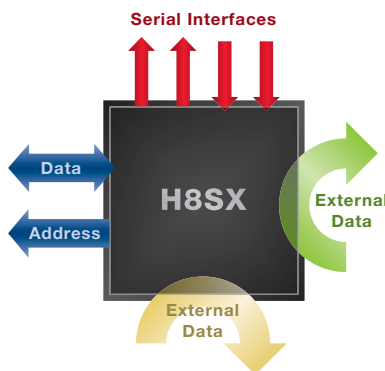
## Notes:

1. Y = Yes, includes 32kHz crystal oscillator circuitry
2. This is the sum of the I/O pins + input-only + output-only.
3. High-current is defined as greater than or equal to 10mA for a signal being driven low. This pin count is included in the GPIO total.
4. Please visit Renesas website for full part number, specification, and availability of extended temperature parts.
5. The specification for this device is subject to change.

## Great Performance for System Connectivity!

Microcontrollers in the H8SX series have high-capacity SRAM, high-performance CPUs, and packages with many pins, making them ideal for complex system hub operation.

Wide Address and Data buses allow connection to multiple external blocks for high-speed data transfers.



Large number of GPIOs and an extensive array of serial interface functions allow connections to any type of external device or function.

Advanced DMA engines within H8SX series can move data between external devices in parallel with on-chip transfers for higher system performance.

## High-performance H8SX CPU Core

32-bit data and address bus, 1-cycle access  
50MHz performance  
HW 32-bit multiplier/divider

High Performance — 50MIPS  
Single-cycle 16-bit x 16-bit

## Improved system throughput

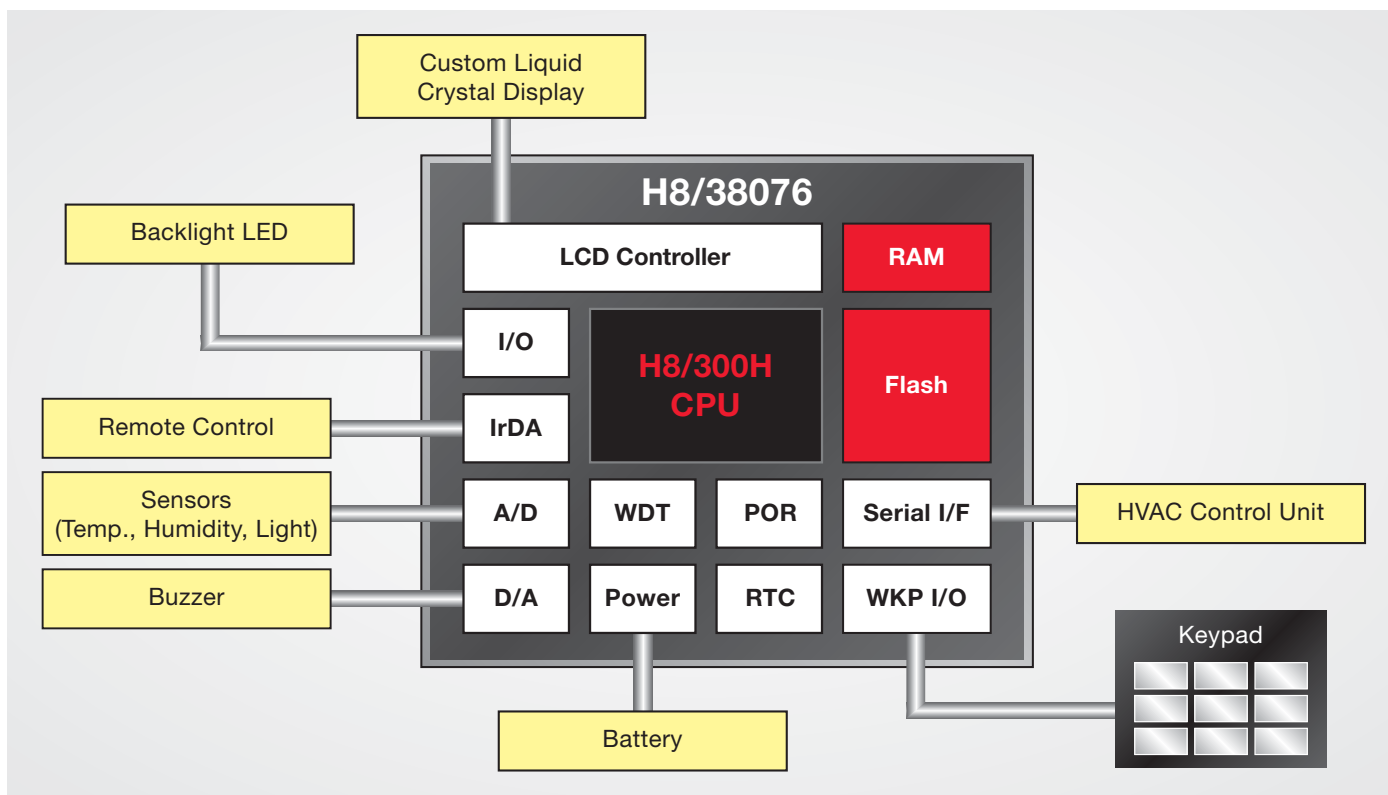
Add specific registers:  
VBR (Vector Base Register)  
SBR (Short-address Base Register)  
Auto Conversion: Big and Little Endian

High response for INT at double speed  
High-speed access to external I/O: 1.3 times  
High-speed network access (Non-overhead, penalty)

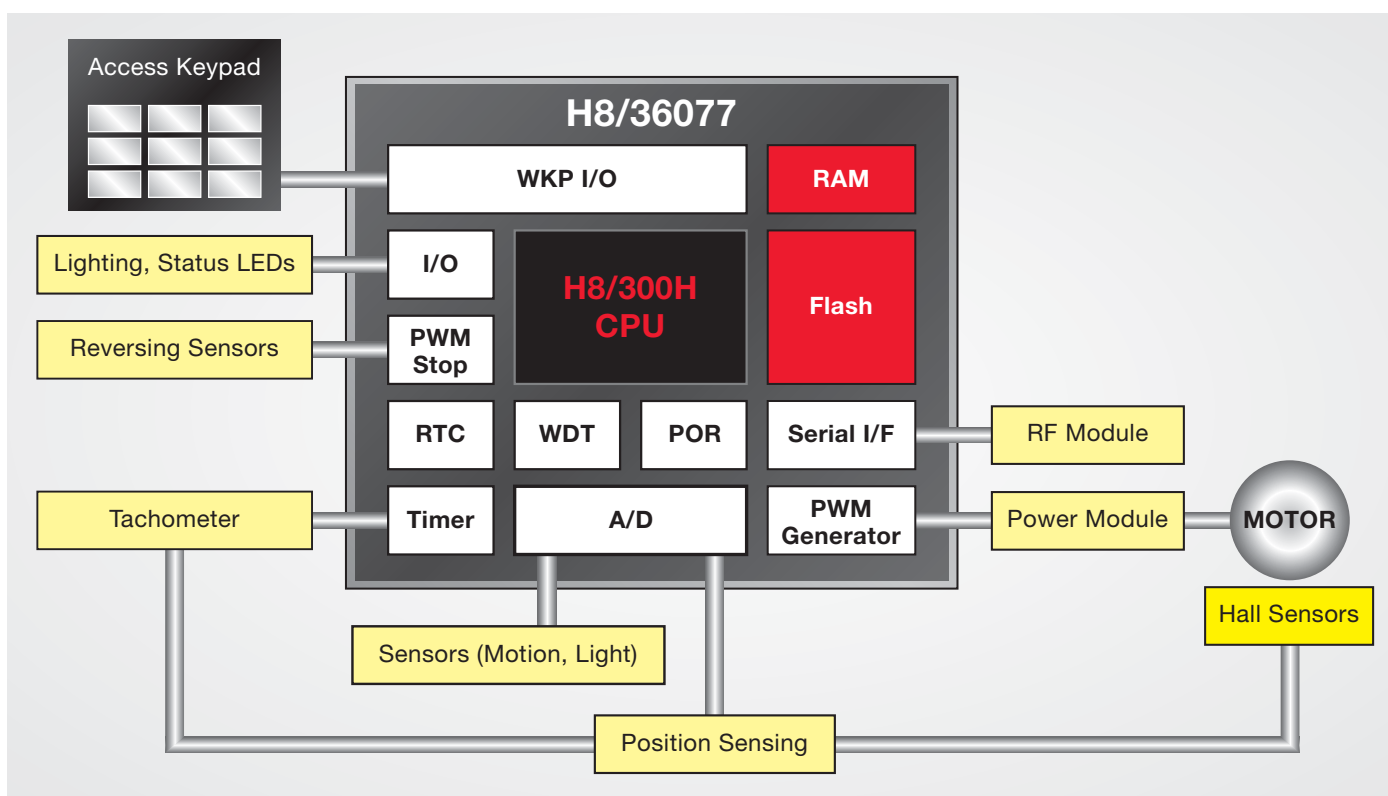
## Compatibility

Enhanced H8 and H8S instruction set and peripheral functions

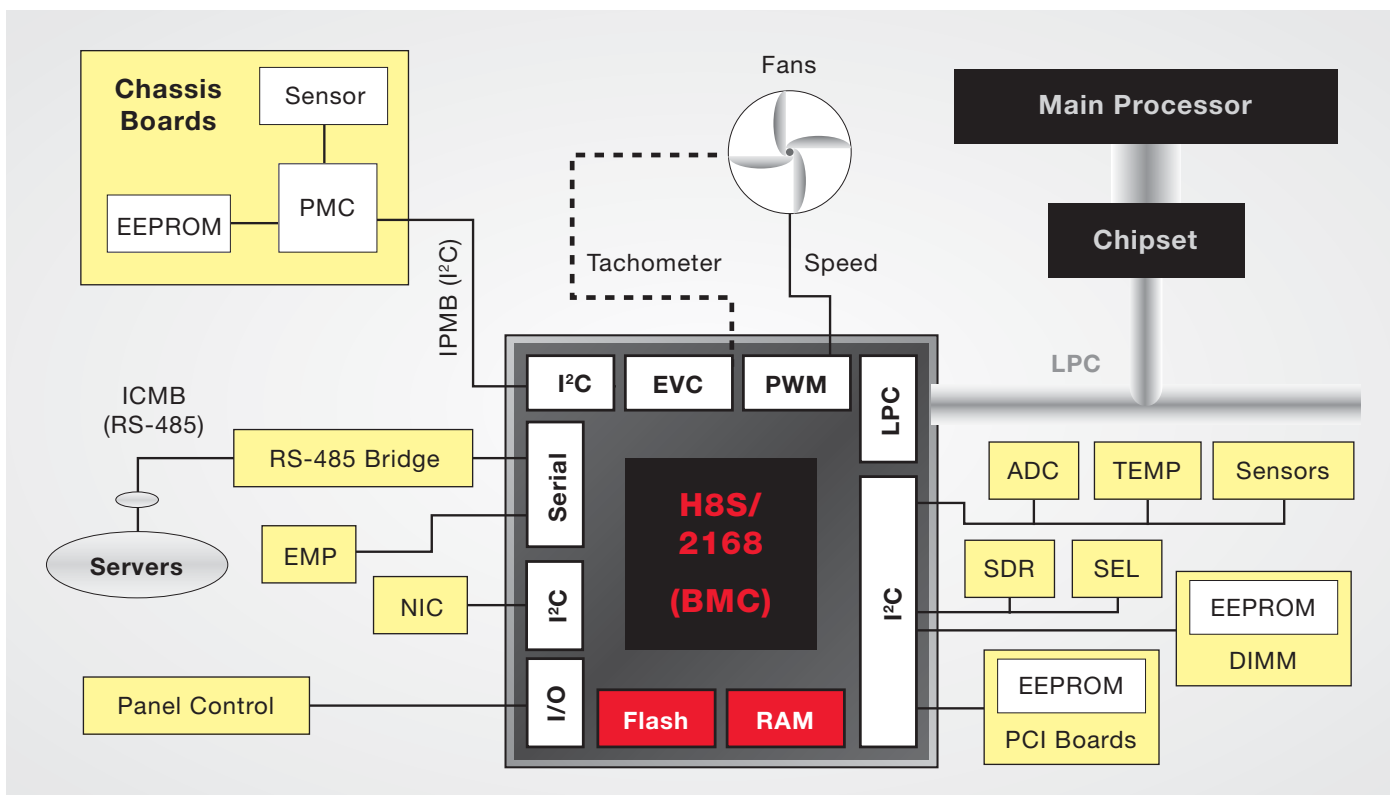
## ■ Application Example 1: Thermostat Solution Using H8/38076R



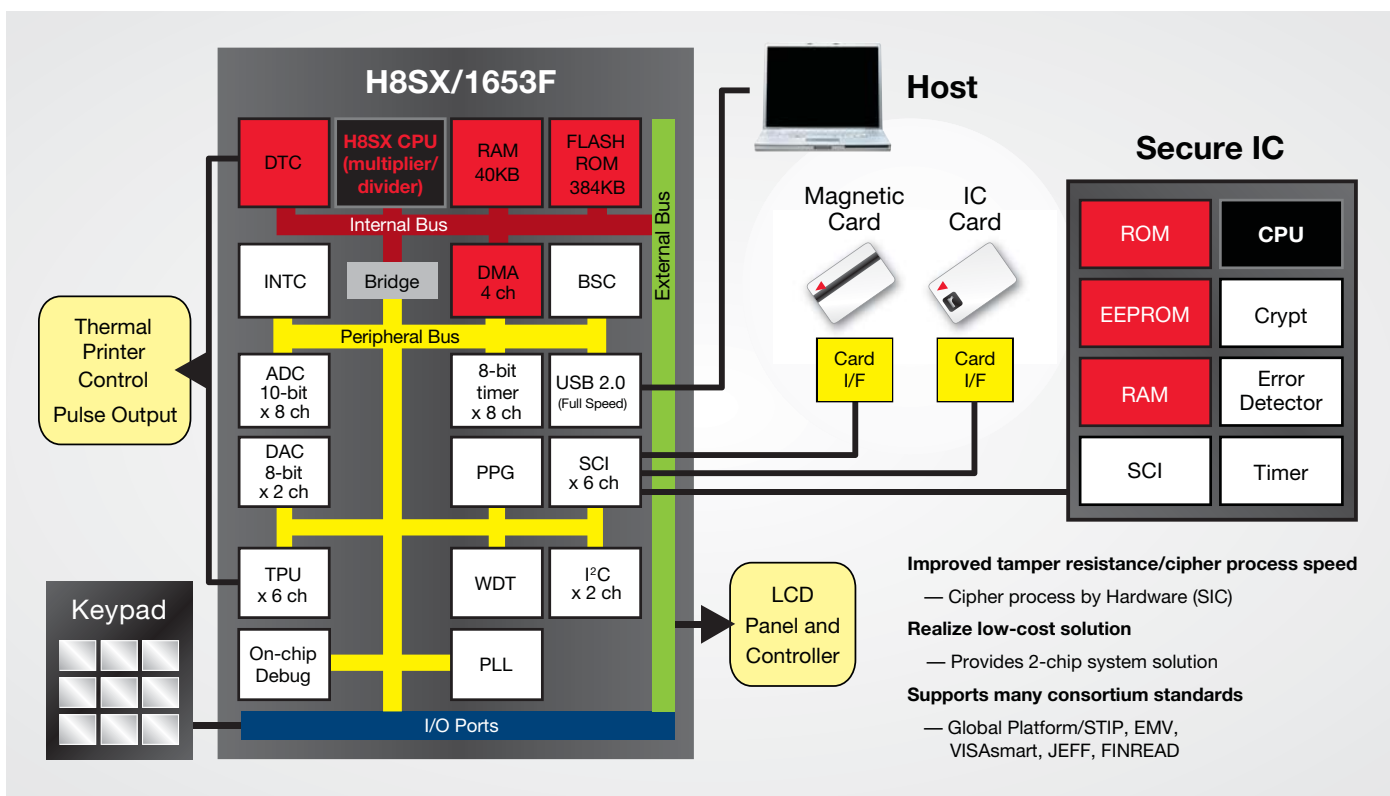
## ■ Application Example 2: Garage Door Controller using H8/36077



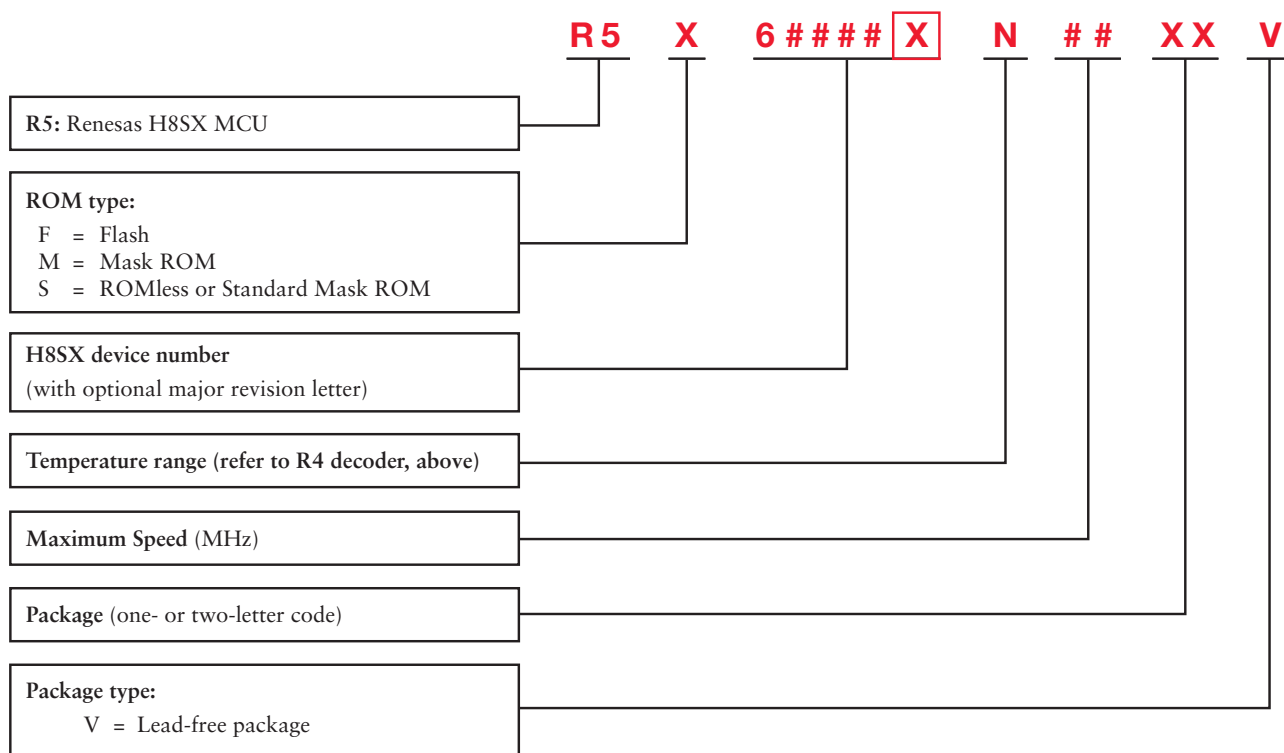
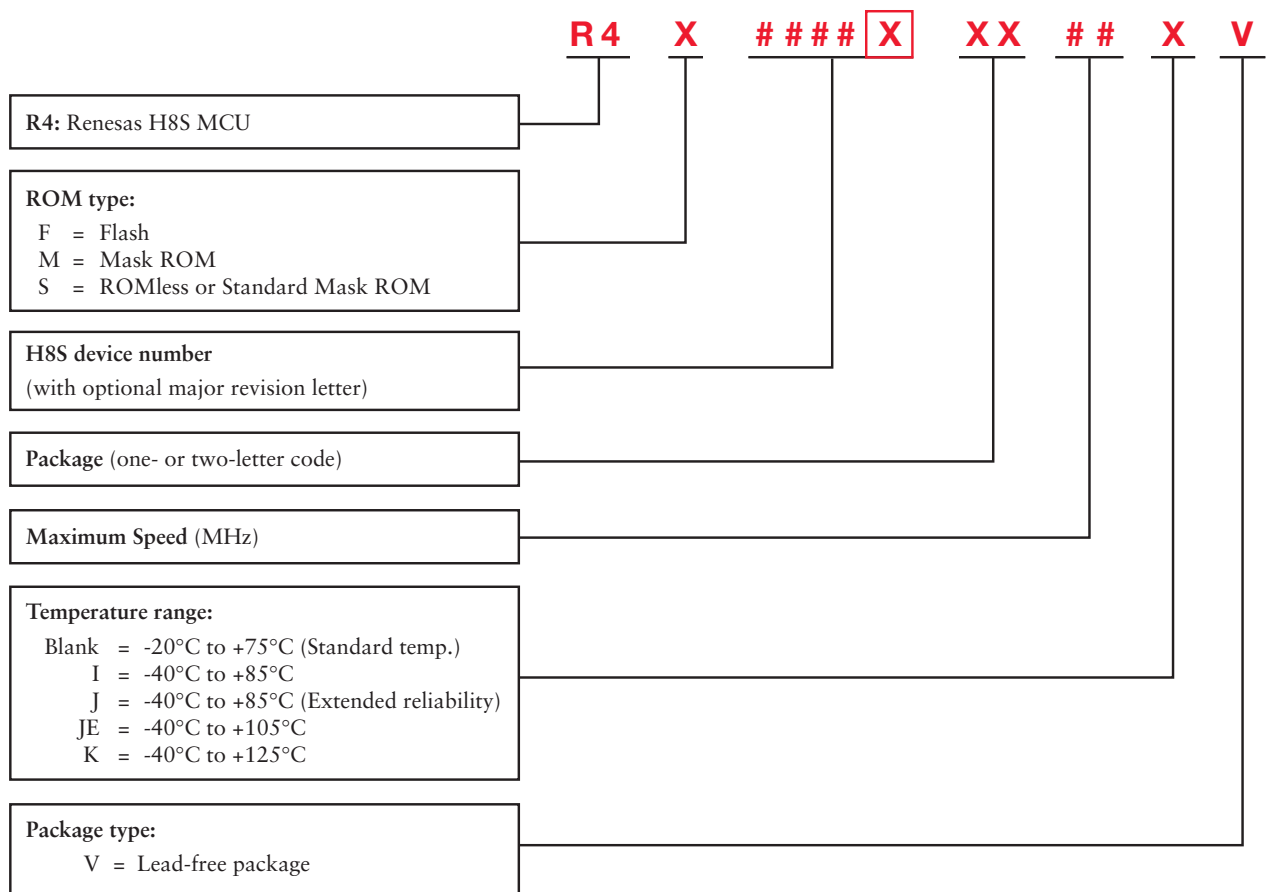
### Application Example 3: Intelligent Platform Management Interface (IPMI) Solution Using H8S/2166



### Application Example 4: ePOS Solution Using H8SX/1653

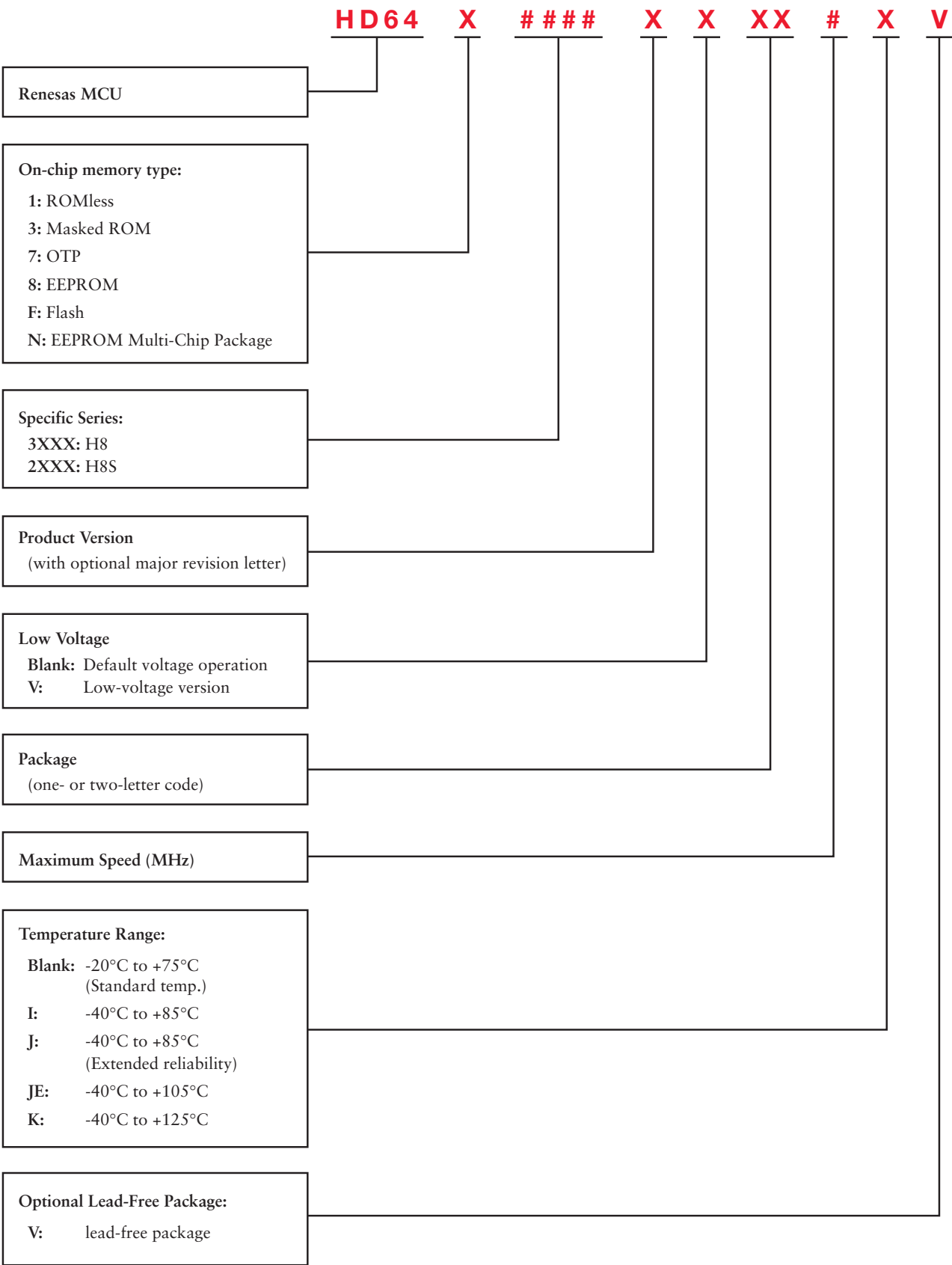


## ■ Appendix C-1: Catalog Part Number Decoders (1 of 2)



# Appendices

## ■ Appendix C-2: Catalog Part Number Decoders (2 of 2)



## ■ Appendix A: Abbreviations

|                  |                                         |
|------------------|-----------------------------------------|
| 15mA IO          | Contains I/O pins that source/sink 15mA |
| 5V IO            | Contains I/O pins which are 5V tolerant |
| ADC              | Analog-to-Digital Converter             |
| AEC              | Asynchronous Event Counter              |
| Boot from USB    | Flash programmable via USB port         |
| BSC              | External Bus Controller                 |
| BSCAN            | Boundary Scan                           |
| BT               | On-chip Memory Bus Trace                |
| CAN              | Controller Area Network                 |
| CRC              | Cyclic Redundancy Check Generator       |
| CTB              | Clock Time Base                         |
| DAC              | Digital to Analog Converter             |
| DMAC             | Direct Memory Access Controller         |
| DMC              | Duty Measurement Circuit                |
| DRAMC            | DRAM Controller                         |
| DTC              | Data Transfer Controller                |
| DTMF             | Telephone Tone Generator                |
| Dual Vcc IO      | Two Vcc domains for I/O Ports           |
| ECF              | Event Counter Function                  |
| EXDMAC           | Enhanced DMA Controller                 |
| HSS              | High-Speed Serial Communications        |
| I <sup>2</sup> C | Inter IC Bus                            |
| IC               | Input Capture                           |

|          |                                             |
|----------|---------------------------------------------|
| IC/OC    | Input Capture/Output Compare                |
| IrDA     | Infrared Serial Port                        |
| ITO      | Interval Timer Operation                    |
| KBD      | Keyboard Scan Function                      |
| LCDC     | LCD Controller/Driver                       |
| LPC      | Low-Pin-Count Interface Bus                 |
| LVD      | Low-Voltage Detect                          |
| MMT      | Motor Management Timer                      |
| OCD      | On-Chip Debug                               |
| OCO      | On-Chip Oscillator                          |
| PC Break | PC Break Controller                         |
| POR      | Power-On Reset                              |
| PS2      | PS2 Interface                               |
| PWM      | Pulse Width Modulation                      |
| ROP      | Read-Out Protection                         |
| RTC      | Real-Time Clock                             |
| SDRAM    | SDRAM Bus Controller                        |
| SPI      | Serial Peripheral Interface                 |
| SSU      | Synchronous Serial Unit (SPI compatible)    |
| TMC      | Timer Connection Circuit                    |
| USB      | Universal Serial Bus Interface              |
| USBH     | Universal Serial Bus Interface – High Speed |
| X-Bus    | ISA Bus Interface                           |

## ■ Appendix B: Package Specifications

|       | Type                            | Renesas Code | Previous Code | Pin Count | Nominal Body Dimensions (mm) | Lead Pitch (mm) | Thickness (mm) |
|-------|---------------------------------|--------------|---------------|-----------|------------------------------|-----------------|----------------|
| QFP   | Quad Flat Package               | PRQP0064GB-A | FP-64A        | 64        | 14 x 14                      | 0.8             | 3.05           |
|       |                                 | PRQP0080GD-B | FP-80B        | 80        | 20 x 20                      | 0.8             | 3.10           |
|       |                                 | PRQP0080JB-A | FP-80Q        | 80        | 14 x 14                      | 0.65            | 3.05           |
|       |                                 | PRQP0100JE-B | FP-100A       | 100       | 14 x 20                      | 0.65            | 3.10           |
|       |                                 | PRQP0100KA-A | FP-100B       | 100       | 14 x 14                      | 0.5             | 3.05           |
|       |                                 | PRQP0100KB-A | FP-100M       | 100       | 14 x 14                      | 0.5             | 3.05           |
|       |                                 | PRQP0128KB-A | FP-128B       | 128       | 14 x 20                      | 0.5             | 3.15           |
|       |                                 | PRQP0144KA-A | FP-144G       | 144       | 20 x 20                      | 0.5             | 3.05           |
|       |                                 | PRQP0144KB-A | FP-144J       | 144       | 20 x 20                      | 0.5             | 3.05           |
|       |                                 |              |               |           |                              |                 |                |
| LQFP  | Low-profile QFP                 | PLQP0032GC-A | FP-32A        | 32        | 7 x 7                        | 0.8             | 1.70           |
|       |                                 | PLQP0048JA-A | FP-48F        | 48        | 10 x 10                      | 0.65            | 1.70           |
|       |                                 | PLQP0048KC-A | FP-48B        | 48        | 7 x 7                        | 0.5             | 1.70           |
|       |                                 | PLQP0064KB-A | FP-64K        | 64        | 10 x 10                      | 0.5             | 1.70           |
|       |                                 | PLQP0064KC-A | FP-64E        | 64        | 10 x 10                      | 0.5             | 1.70           |
|       |                                 | PLQP0100KB-A | FP-100U       | 100       | 14 x 14                      | 0.5             | 1.70           |
|       |                                 | PLQP0120LA-A | FP-120B       | 120       | 14 x 14                      | 0.4             | 1.70           |
|       |                                 | PLQP0144KC-A | FP-144H       | 144       | 20 x 20                      | 0.5             | 1.70           |
| TQFP  | Thin QFP                        | PTQP0080KC-A | TFP-80C       | 80        | 12 x 12                      | 0.5             | 1.20           |
|       |                                 | PTQP0100KA-A | TFP-100B      | 100       | 14 x 14                      | 0.5             | 1.20           |
|       |                                 | PTQP0100LC-A | TFP-100G      | 100       | 12 x 12                      | 0.4             | 1.20           |
|       |                                 | PTQP0120LA-A | TFP-120       | 120       | 14 x 14                      | 0.4             | 1.20           |
|       |                                 | PTQP0144LC-A | TFP-144       | 144       | 16 x 16                      | 0.4             | 1.20           |
| LFBGA | LF Ball Grid Array              | PLBG0112GA-A | BP-112        | 112       | 10 x 10                      | 0.8             | 1.40           |
|       |                                 | PLBG0176GA-A | BP-176        | 176       | 13 x 13                      | 0.8             | 1.40           |
| TFBGA | Thin Fine-Pitch BGA             | TTBG0112GA-A | TBP-112A      | 112       | 10 x 10                      | 0.8             | 1.20           |
| SDIP  | Shrink Dual-Inline Package      | PRDP0032BB-A | DP-32S        | 32        | 28 x 8.9                     | 1.78            | 5.08           |
|       |                                 | PRDP0064BB-A | DP-64S        | 64        | 57.6 x 17                    | 1.78            | 5.08           |
| TFLGA | Thin Fine-Pitch Land Grid Array | PTLG0085JA-A | TLP-85V       | 85        | 7 x 7                        | 0.65            | 1.20           |
|       |                                 | PTLG0113JA-A | TLP-113V      | 113       | 8 x 8                        | 0.65            | 1.20           |
|       |                                 | PTLG0145JB-A | TLP-145V      | 145       | 9 x 9                        | 0.65            | 1.20           |
| QFN   | Quad Flat Non-lead Pkg.         | PVQN0048KA-A | TNP-48        | 48        | 7 x 7                        | 0.5             | 1.00           |
| VQFN  | Very Small QFN                  | PVQN0032KA-A | TNP-32        | 32        | 5 x 6                        | 0.5             | 0.95           |
| SOP   | Small-Outline Package           | PRSP0032DC-A | FP-32D        | 32        | 11.3 x 20.45                 | 1.27            | 3.00           |

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| DF2140BTE10V               | TFP-100B            |                             |                            |                 |                   |                  |                    |                   |                      |

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ON: Oscillator (F3)

Use LED's

LED 1

LED 2

LED 3

Frequency: 20.0 (MHz)

Frequency

0

20 MHz Crystal

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MCU Power Jumper JP1

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